Noesis

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EDITORIAL
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April 15, 1993

Dear Rick:

A LETTER FROM RON HOEFLIN

I believe that Chris Cole's approach to the nature of intelligence is a bit too a priori rather than empirical. This is an odd criticism to make of Cole, who no doubt prides himself on being a thoroughgoing empiricist rather than aprioristic philosopher. So why do I say his approach is too a priori?

First, he did not follow my advice and present all 41 of my best verbal analogies to Mega Society members and subscribers in order to find out empirically which problems discriminated best between higher and lower scorers. Instead, he chose the 12 problems that he himself subjectively intuited to be the best problems. He had reasons for his choices, of course, but so did those philosophers who spent centuries arguing about universals during the Middle Ages. And he did not stick consistently with his reasons in selecting the 12 analogies he liked best. For example, the problem HUMBUG : BACH :: SEEK : ? violates his rule against relying on word play. By revealing the answers to the problems he discarded, he compounded his anti-empiricism by making it more difficult to retain the problems he singlehandedly decided to discard.

I did give him permission to make use of problems I had developed in creating the Ultra Test as a hybrid of problems contributed by both me and other Mega members. I'm just disappointed that he proceeded to reveal the answers of all the problems he discarded without consulting me first, especially since he chose to select a meager 12 problems out of the 126 or so problems I had developed over a period of many months. My view now is that I ought to select 24 problems for the first half of the Ultra Test, drawing mainly from my own problems, and that Chris should select 24 problems for the second half of the Ultra Test, drawing mainly from problems contributed my other Mega members or subscribers. If this is how we proceed, then I may use a slightly different set of verbal analogies than the 12 he selected for the verbal part of my half of the Ultra Test, even though some of the problems have been spoiled for Mega members and subscribers by having had their answers revealed prematurely.

The foregoing comments pertain to Noesis #79. In Noesis #80 he comments on the Concept Mastery Test by asking, "Is a spelling bee an intelligence test?" I suppose I am biased because I did well on the CMT, as I have done on other verbal tests such as the GRE verbal aptitude scale and the Bloom Analogies Test. What impressed me about the CMT is that it reached a fairly high ceiling (about the 1-in-100,000 level) using problems that are comparatively simple, but in large numbers, there being a total of 190 problems on the CMT. Unlike Cole, Terman developed the CMT empirically rather than aprioristically. He started out with nearly 500 problems, I believe, and selected the best problems chiefly on the basis of their having discriminated best between high and low scorers—the same methodology I would have advised for selecting the 24 best verbal problems from my 126 problems. I would have allowed members and subscribers to rate each problem in terms of how elegant or satisfying it

seemed to the test taker, giving us an extra criterion for selecting a final set of problems. This would have been better than relying on the subjective appraisal of just one member, namely Cole.

I don't think that developing a good vocabulary is usually achieved in the same way that one develops a good spelling ability, namely by learning a few spelling rules and relying a lot on rote memory. Most vocabulary is learned gradually through ordinary reading and conversation. And studies repeatedly show that the size of one's vocabulary has an excellent correlation with overall intelligence. There is a book published back in the late 1950's or early 1960's titled Intelligence in the United States that documents this quite extensively. I believe that Terman refers to such correlation studies, too, in his book, The Gifted Group at Mid-Life, in which he discusses the results of testing his gifted group on the CMT and his rationale for using such a test, which he explicitly states should not be considered an intelligence test per se but merely a test that correlates well with intelligence. In Bias in Mental Testing I believe that Arthur Jensen argues that ability in math, music, and chess are specialized aptitudes, since one finds child prodigies with each of these talents. General intelligence, on the other hand, I believe he considered to be primarily verbal in nature. I have not read his book thoroughly enough to recite his reasons for this conclusion, but one might argue that verbal ability is one of the oldest distinctly human traits, which has had an opportunity to evolve gradually over tens of thousands of years, whereas chess, music, and math are relatively recent innovations, which have not played a large role in human progress until very recent times. In any case, correlation studies do show that vocabulary does correlate well with general problem-solving ability. Why? Perhaps the learning of words by devining their meaning from context is a problem-solving activity par excellence. When we take a vocabulary test we do not sense that our intelligence is being tapped because either we know a word or we don't—there's no struggle involved. But this ignores the fact that in amassing a vocabulary in the first place there was a struggle involved. So a vocabulary test simply taps past rather than present problem-solving activity. And surely it is better to tap the problem solving that has engaged one for years or decades than what one can struggle through in just a few minutes or hours on a timed math test or timed intelligence test. It is true that one can artificially boost one's vocabulary in preparation for a verbal aptitude test, but if the verbal test is innovative enough, it is unlikely that such test preparation will have a significant impact on one's score, or at least no more of an impact than cramming for any other sort of problem-solving activity that one has reason to expect on a test. I know people who have even "crammed" for intelligence tests by practicing repeating random numbers both forwards and backwards until they become very good at it, which presumably artificially boosts their scores on the "digit span" portion of the Wechsler tests, in particular. I just doubt that vocabulary size is significantly more vulnerable to artificial boosting than most other types of problem-solving situation.

One advantage of a two-part Ultra Test is that we could use the first half of the test as a lure to pique the curiosity of people who might want to see what sorts of problems Mega members have submitted, the second half of the Ultra Test perhaps being sent only to those who try the first half. We could even offer to reveal the answers to the first half of the

test for publication on the condition that the answers to the second half would not be published. The second half performance would be the crucial one for deciding whether someone is qualified for the Mega Society, since it would contain most of the harder problems. The disadvantage of revealing answers to the first half of the test is that that half could presumably no longer be used as an admission test for the lower-IQ societies such as my Top One Percent Society. But it could at least serve as a lure for people to try my two previous tests, the Mega or Titan tests, if they seek admission to one of the lower-IQ groups. And perhaps a would-be publisher would not insist on our revealing any problems at all, in which case the entire test could continue to be used as an admissions test for the whole range of high-IQ societies.

These ideas are, of course, tentative. A lot depends on what problems we have to choose from when we compile the final Ultra Test this September as well as on what demands are made upon us by a would-be publisher. Chris argues that we should try for an audience other than Omni, this time, such as Scientific American readers. I can't imagine Scientific American publishing our test any more than a psychometric journal would welcome an analysis of any untimed, unsupervised tests. A paid advertisement would perhaps work, but it would be expensive and the income from such a venture might not pay for the cost of such an ad. So we may be stuck with Omni or similar unorthodox journals, in view of our own unorthodox methodology.

Ronald K. Hoeflin
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[Ed's comment: Congratulations to Ron Hoeflin on the dismissal of the nuisance suit against him for reprinting an uncopyrighted article.]

MORE ON THE SHORT FORM TEST BY CHRIS COLE

I first want to apologize to Ron Hoeflin for publishing the answers to several of his questions. This resulted from a misunderstanding on my part. I thought that Ron was donating all these problems to the Short Form Test, and that he did not intend to do the Ultra Test. I published the problems (and regrettably the answers) because I needed some examples of what is wrong with current hi-end tests, and it is exceedingly difficult to come up with good questions for examples. Since I thought these problems were basically "retired," I did not think it was wrong to publish them. I hope I have not compromised them beyond repair. Sorry, Ron.

As should be clear from Ron's preceding letter, the plan to consolidate the Short Form Test and the Ultra Test is defunct. Ron will go forward with the Ultra Test on his own, and I still hope one day to put together the Short Form Test with the help of the rest of you. By the way, we are now in need of a name, as the name "Short Form" is a misnomer. The test will not be any shorter in form than the Mega, Titan or Ultra, although hopefully it will be shorter in time. Since I note that members are rather good at coming up with creative names, perhaps one of you will be inspired. If so, please pass along the result.

With that said, let me rush to my own aid and attempt to resurrect my reputation as an empiricist. Ron argues that we should let discrimination value alone determine our choice of test questions. I am of course in basic sympathy with this statement, but I have two systematic objections:

1. The population on which the trial questions are being tried is not being randomly sampled from the world's population as a whole. This leads to a systematic bias, which is the bane of all statistics. I am reminded of the story of the student defending his Master's thesis. Part of the thesis was a statistical survey conducted by the student. One of the professors on the thesis defense committee asked the student how he had conducted his survey. The student answered that he had randomly selected locations in the city to stand and interview people. The professor asked when the student did this. The student answered that he did it Tuesdays and Thursdays at 4:00 p.m. The professor asked how these times had been chosen. The student answered that they were the only times that he did not have classes. The student's thesis was rejected, because the survey was systematically biased by the times the student chose to conduct the interviews.

Now, how can we correct for the sampling bias of the trial test process? The complete answer to this question is probably quite difficult to formulate. But we can at least avoid some of the obvious problems of culture-bias, such as questions relying on knowledge of Greek mythology, English etymology, etc. Lest anyone think this is academic, I have personally spoken with people who object to the Mega test and cite this as their main reason.

2. Some questions can be answered well by a computer which has access to a large dictionary, encyclopedia, almanac, etc. Not everyone has access to such things, but as time passes more and more people will, and the ability to do simple information retrieval is not a test of intelligence. We already implicitly acknowledge this when we exclude questions requiring specialist knowledge from the test. Ron, for instance, will not use a math question that requires calculus. (Ironically, I do not agree with this, since I think virtually every high school in the country now teaches calculus). We all agree that questions requiring, say, specialist knowledge of archaeology are inappropriate. Why? Because we are trying to measure intelligence, not knowledge acquisition. And we are trying to measure it in an unbiased way. So, a question about the social mores of the Etruscans is biased in favor of a specialist, who would come by such knowledge not by way of superior intelligence, but rather by way of making a living.

This is a rather fine line to draw. We like analogies like:

A, AB, B, BO, O : BO :: A, C, E, G, T: E

because we think that people "should" know about blood types and DNA bases, but of course not too long ago this was specialist knowledge, and not too long before that it was nonexistent knowledge.

Perhaps like the Wizard of Oz we want to test what people have learned when they weren't trying to learn.

It is easy to criticize. Can I come up with some problems that (1) are not culturally biased, and (2) cannot be solved by computer? I have used the resources of the Internet to try the following set of problems out on our very small population of networked-connected Mega members (currently, seven of us). Every one of these problems was solved by at least one Mega member. Also, most of the problems have very good near solutions, which may allow us to do something that Rick has argued for: assign partial credit. So, try these out and send in your answers: Also, let us know which of Peter Pomfrit's problems meet the above criteria, and try out Peter Schmies' problems below.

32. backbone : tailbone :: letter : ?
33. purple : orange :: child : ?
34. mirror : mercury :: balloon : ?
35. queen : knight :: telescope : ?
36. horse : saddle :: wind : ?
37. nail : screw :: musket : ?
38. stereo : monaural :: drumsticks : ?
39. mop : evaporate :: shovel : ?
40. grass : trees :: bacteria : ?
41. chameleon : mocking bird :: circus : ?

TWO PROBLEMS FROM PETER SCHMIES

42.	6	20	14	
	4	15	7	
	10	39	?	
	9	53	26	
43.	B-V	H-N	P-R	C-?

LETTER AND TEST FROM ALAN AAX May 12, 1993

Rick Rosner:

I was recently told that my Four Item Test (FIT) was published in the journal of the Mega society, which I think you edit. If this is indeed the case, I am glad you decided to publish FIT and I would like to obtain a copy of the issue containing it. If possible, please send me that issue and I would pay promptly for it and for the shipping cost.

I am enclosing a copy of my new test, EIT (Eight Item Test). This is a very difficult test. I expect (without having much evidence to support this expectation) that only about one person of every million (in a population with a normal distribution) will be able to solve six or more problems, and that about one person of every thirty thousand will be able to solve four or more problems. I am very interested in seeing how Mega members will perform on this test, and therefore I would like you to publish it. If you do, please try to do so *without* reducing the size of the figures. If necessary, consider printing the test rotated 90 degrees with respect to the normal text orientation. Also, please send me the corresponding issue and bill me for it. (I am assuming that each issue will cost me less than $10. If that is not the case, let me know *before* you send me the issues.)

Thank You

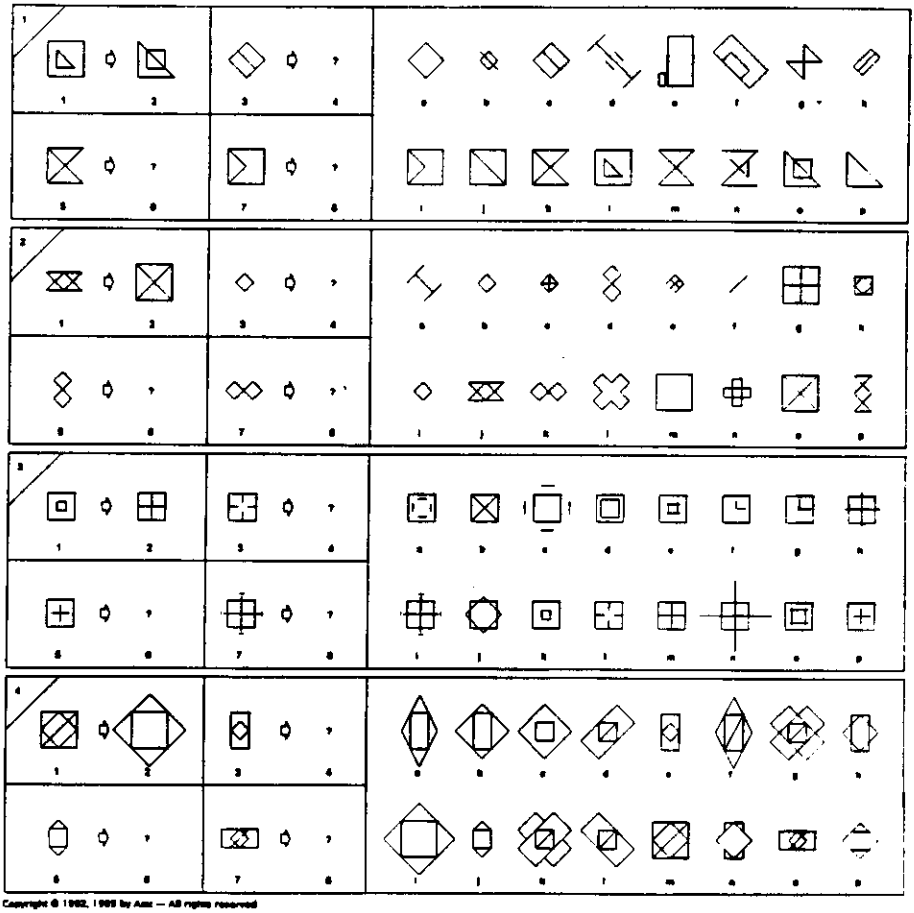
Aax
Box 1391
Princeton, NJ 08542

EIT 1.1 (Eight Item Test)

I have designed the following problems to study high intelligence. Each of the following eight problems has one correct solution. The correct solutions are relatively straightforward and, once perceived, will usually leave little doubt regarding their correctness. I have not attempted to mislead the test taker or to "hide" higher-level problems beyond what is specified in the instructions (e.g., the letters of the answers have not been selected so as to spell out a sentence). However, these problems have been designed to be extremely challenging. I expect that very few people will be able to find more than one or two correct solutions. If you are seriously interested in finding the correct solutions, do not give up on a problem until you have spent at least several hours trying to solve it. (Then again, the correct solution may just "jump out" at you.)

For each of the eight problems, find an operation that when applied to figure 1 yields figure 2 and when applied to figure 3 yields one of the first eight lettered figures ('a' through 'h'). Once you have found such a *viable* operation (and there should be very few), apply that operation to figure 5 and figure 7. If you thus obtain figures that are among the sixteen lettered figures ('a' through 'p'), you have a *valid* operation. If your viable explanation is not valid, repeat the process. Finally, if your valid explanation is too complex or inelegant, repeat the process. When you find a good, valid operation (a simple and elegant, valid operation), report your answer by writing the problem number followed by three letters corresponding, respectively, to figures 4, 6, and 8. Remember that the first letter is restricted to 'a' through 'h'. Therefore, '6mna' is *not* a valid answer. Repeated letters (e.g., "1aaa") are allowed. Aax — Box 1391 — Princeton, NJ 08542

Instructions continue on page 2.

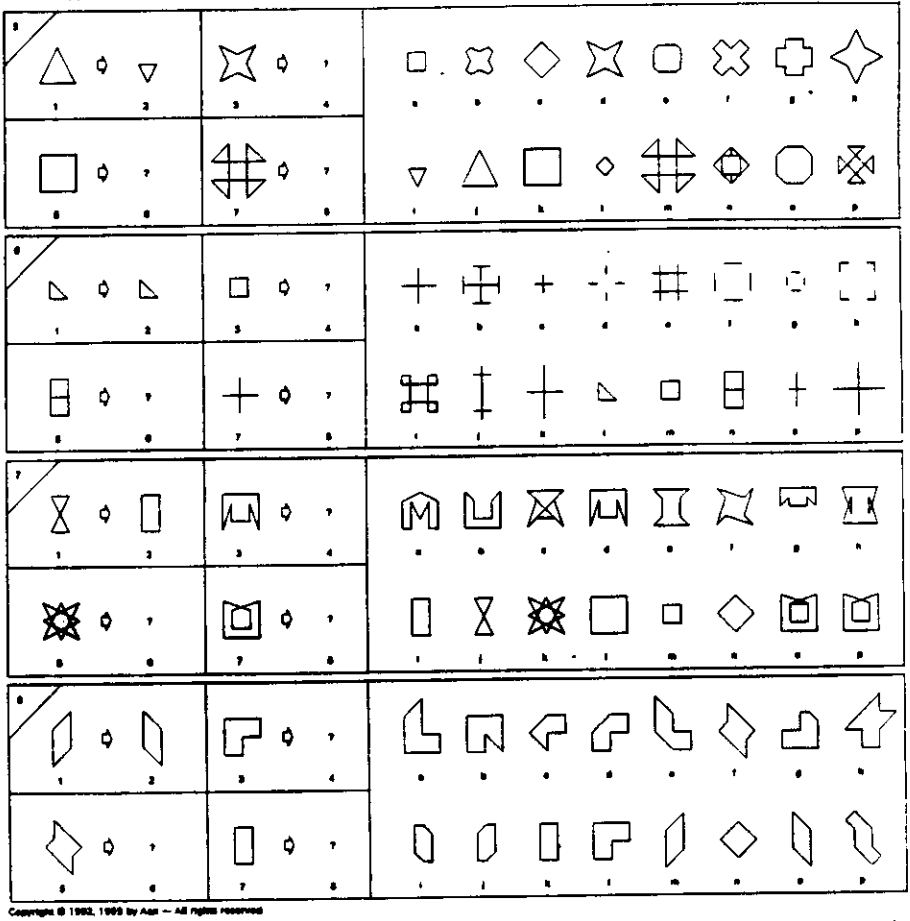


EIT 1.1 (Eight Item Test)

When working on the problems, keep in mind the following points: (1) All figures are drawn to scale with high accuracy (as an extreme example, notice that in figure 3J the two squares are *not* of the same size, a fact that is easily perceived by noting that all triangles formed by their intersections are not equal). (2) All lines should be considered perfectly straight and to have no thickness. (3) Many of the figures can be obtained by drawing lines between intersections in a 4 by 4 grid; the others require a larger grid (32 by 32 will suffice for all of them). (4) Sizes, relative proportions, and relative positions matter. (5) A good explanation should require 4 or fewer "steps" (every step is a simple operation applied identically to one or several parts of a figure; e.g., rotate 45 degrees). (6) Do not settle for a valid explanation; find a *good* one.

To practice working on problems of this type, I highly recommend that you first try SSFIT (Self-Scoring Four Item Test), a *much* easier test. You can obtain it by sending me a SASE and $1. To obtain your EIT score, mail me a sheet containing your answers and as much as possible of the following data: full test name (i.e., "EIT 1.1"), name, address, age, sex, SAT scores, GRE scores, and scores on IQ tests. Also, please provide three lists ranking the problems by: (a) how difficult you found them, (b) how much you like them, and (c) how satisfied you are with your answer. Finally, please indicate how much time you spent on each item. (Your score will be based solely on your selection of figures.) Explanations are not required, but could help me to detect errors in the test. I will appreciate a donation of $10, as it will help to cover the costs of test distribution.

You can copy and distribute EIT as long as you include the copyright notice and do not charge for it. Aatr — Box 1391 — Princeton, NJ 08542



HEAVY ICE VERSUS LIGHT WATER

HEAVY ICE VS. LIGHT WATER BY ROBERT DICK

By Robert Dick
13 Speer Street
Somerville, NJ 08876

My office mate at work recently wondered aloud the following question: We know that heavy water (D2O) is heavier than light water (H2O). We also know that due to some peculiarity ice is lighter than water; that's why it floats. Question: Would heavy ice sink or float in light water?

A trip to the library provided me with a plausible answer. (Light) water at 0 degrees C has a density of 999.8 kg/m**2. (Light) ice at that temperature has a density of 916.0.

Light water at 25 degrees C has a density of 997.1 kg/m**2. Heavy water at that temperature has a density of 1104.7.

Conclusion: Assuming the light to heavy ratio holds for ice as it does for water we have:

Heavy ice/light ice = heavy water / light water = 1.108
Light ice/light water = 0.9162
Therefore heavy ice/light water = 1.015

Consequently, heavy ice sinks in light water.

This should be a rather amusing experiment to try, don't you think?

LETTER FROM CHRIS HARDING CONCERNING CTMU

Dear Rick:

I have read Chris Langan with considerable interest and I believe I have understood the point he is driving at. As others have pointed out, THERE STILL REMAINS A DIFFICULTY. Using CTMU can he provide us with the NEW IDEAS that can lead to verification through the experimental process? Does it point to things as yet unknown? A theory of everything would through expansion lead to everything that we now don't know of and be able to tell us everything about everything. True, such an "expansion" may still be some time off and any failure in this regard may not necessarily prove fatal. However, interesting results may be close at hand given the rightness of his "frame."

I believe the failure of the General Theory of Relativity may be found in the fact that the form of these equations are those of the simple partial differential. This as much applies to Quantum Mechanics. No wonder they are both in conflict! The reality is, such equations cannot deal with infinities. Reflecting on this suggests that this failure can similarly be found in the structure of language logic and the very conceptual process on which all of our human culture rests and is a profound social (external) limitation of the human mind [cf. the paradox].

Can I then issue a challenge to Chris Langan to solve the N. Chomsky puzzle and give us the underlying structure on which language rests? and give us a tool for dealing with the conceptual difficulties we are beset with.

Best Regards,
Chris Harding

COMPLETING THE LORENTZ TRANSFORMATION

Nov 92
Rev 2/20/93
Rev 3/26/93

ABSTRACT: The conventional interpretations of the Lorentz Transformation equations ignore the sole definition of, and relationships among, x, x', t, and t' on which its derivation is, and must be, premised. The conventional view also ignores the fact that the LT is applicable only to motion at C relative to a frame of reference which is, in turn, moving at constant linear speed relative to the observer's frame of reference. Correcting for these errors yields a different, completed, Transformation which eliminates time paradoxes, and invalidates all experimental proofs of Special Relativity except the Doppler effect in electromagnetic radiation.

****

The Lorentz Transformation is the **entire** mathematical premise of Einstein's Theory of Special Relativity. Supposedly, it tells us that:

a) Nothing whatsoever can move faster than light (electromagnetic radiation) relative to anything else; the velocity of light in a vacuum (C) is an absolute speed limit.

b) Only light (electromagnetic waves), nothing else, can traverse empty space at C.

c) It is **impossible** for anything having mass to move at C, because its mass approaches infinity as its speed relative to anything else approaches C.

d) In moving objects, distances and lengths in the direction of motion increase with speed relative to anything else, and become infinite when that speed equals C.

e) Time durations in moving objects increase toward infinity as their speed relative to anything else increases toward C.

The Theory of Special Relativity is premised on two simple ideas:

1) The laws of nature are the same in all inertial frames of reference (IFRs), and

2) The speed of propagation of light in a vacuum (C) is the same in all IFRs.

Mathematically, a frame of reference (FR) is only a set of three immaterial mutually-perpendicular coordinates, against which the spatial dimensions may be measured. A frame of reference becomes an inertial frame of reference (IFR) when it is moving at a constant speed in a straight line relative to another frame of reference. Physically, the earth and a spaceship moving at a fixed speed in a straight line relative to each other may each be considered to include a frame of reference, and are therefore a pair of IFRs. The same may be said of any other pair of things

moving through empty space at a fixed linear speed relative to each other.

Lorentz, Einstein, and many others have derived the equations that tell us the size of the dimensions of x, y, z and t of one IFR as they are measured by an observer in another IFR. It is assumed that the observer can always make these measurements with perfect accuracy, regardless of the relative speed or distance of the two IFRs. While there are many different ways to derive these equations, the results are always the same:

(1-1) $x' = (x+St)/\sqrt{(1-S^2/C^2)}$
(1-2) $t' = (t+Sx/C^2)/\sqrt{(1-S^2/C^2)}$

x = a distance along the x-axis of the IFR being observed.
t = a time interval as measured by a perfect clock in the IFR being observed.
x' = x as measured by the observer using perfect instruments in his own IFR.
t' = t as measured by the observer using a perfect clock in his own IFR.
S = the linear and constant relative speed (in the direction parallel to x direction) of the IFR being observed relative to the observer's own IFR.
C = the velocity of propagation of light in a vacuum.

[**Note a:** (1-1) and (1-2) may be used for the y or z dimensions by substituting those symbols, as appropriate, for x. **Note b:** (1-1) and (1-2) **must be evaluated simultaneously.**]

Equations (1-1) and (1-2) <u>are</u> the Lorentz Transformation. All they "transform" is the size of the dimensions of one IFR to those of another. The observer can be in either IFR, with no effect on his measurements of the dimensions of the other IFR. (1-1) and (1-2) tell us nothing about the observer's own IFR, because he can not perceive any changes in its dimensions as it moves relative to another IFR. It is vital to understand that (1-1) and (1-2) do not "move" x or t to the observer's IFR; they remain in, and relative to, the IFR under observation.

(1-1) purportedly tells us that a distance or a length in the direction of relative speed appears to increase as that speed increases. We are often told exactly the opposite, because of another equation derived from the LT, called the Lorentz-Fitzgerald Contraction. However, (1-1) is the actual LT equation.

(1-2) purportedly tells us that a time interval aboard a spaceship moving relative to the earth at a large fraction of C will be longer as measured by a perfect clock on earth than as measured by an identical clock aboard that ship. As perceived by an observer on earth, a trip at a very high speed to a distant star will take less time as measured by a perfect clock on the spaceship than as measured by an identical clock on the earth. For example (ignoring $+Sx/C^2$), an observer on earth, who can somehow see a perfect clock aboard a spaceship, will see that clock count off 10 years (while the spaceship is moving at 0.999C relative to the earth) while his own identical perfect clock on earth counts off

223.6 years. At 0.9999C, the same 10 years on the ship's clock will take 707.1 earth-years. Paradoxically, (ignoring $+Sx/C^2$) an observer aboard the spaceship, who can somehow see the clock on earth, will see it count off 10 years while his shipboard clock counts off 223.6 years, the ship travelling at 0.999C relative to earth all the time.

Various theoreticians have used the LT to derive additional relationships. Most important are:

(1-3) The Velocity Transformation: $v' = (v+S)/(1+vS/C^2)$
(1-4) The Mass Transformation: $M = Mo/\sqrt{(1-S^2/C^2)}$

These equations are **not** members of the LT. They are mathematically derived from the LT, employing certain additional assumptions.

Equation (1-3) is obtained by dividing (1-1) by (1-2) and assuming that $x/t = v$ and $x'/t' = v'$. It supposedly tells us that it is not possible for anything other than light to travel at a speed equal to C, and that nothing whatsoever can travel at a speed greater than C. It also supposedly tells us that C does not change as a result of the speed of its source relative to an observer; that we will measure the speed of propagation of light coming to us from a spaceship moving toward us at 0.999C to be exactly C, not 1.999C. (Note: despite the fact that all velocities in SR and the LT are defined to be constant, making average velocities equal instantaneous velocities, some insist that the Velocity Transformation equation must be derived on the basis that $dx/dt=v$ and $dx'/dt'=v'$, using differential calculus. The logic and the results are the same.)

Equation (1-4) supposedly tells us that if an object has mass $M = Mo$ when it is stationary relative to an observer, that M will increase as its speed (S) relative to the observer increases. As S increases toward C, the object's mass will increase toward infinity. Thus, according to equation (1-4), it is not possible for an object having mass to travel at the speed of light, and highly impractical for any such object to travel at a speed very close to C because of the vast energy required to accelerate even a tiny mass to such a speed.

We are often told by many authorities on Special Relativity that these equations, particularly (1-2) and (1-4), have been proven to be true by many experiments.

There is a serious anomaly in such proofs, because (1-1) and (1-2) are not the proper and final algebraic results of any of the many possible derivations of the LT. All derivations stop short of completion; for some unknown reason they are not continued until the number of dependent variables is minimized in each transformation equation. Specifically, (1-1) contains the quantity St and (1-2) contains the quantity Sx/C^2. [Experiments which supposedly prove (1-2) usually ignore Sx/C^2 as being "insignificant", which is not true]. If we examine the premises of all possible derivations of the LT, we must always (explicitly or implicitly) find:

(1-5) $x/t = C = x'/t'$

(1-5) is essential to the LT: it is the sole avenue by which those terms enter the mathematics. It says that speed x/t = speed x'/t' = speed C, which is the fundamental premise of Special Relativity stated in par 2, above. We will also find that (1-5) **is the sole definition of x, t, x', t' and C, and of their relationships, in any derivation of the LT.**

It is a basic tenet of algebra that two or more different definitions of exactly the same variable(s) cannot be used within a single analysis. Thus it is incorrect to state that x/t = v, having already said that x/t = C, unless we understand that then v must equal C. Given (1-5), any other velocity involved in deriving the LT, such as S, must be stated as C multiplied by a numerical constant, such as S = ßC.

It is also a basic tenet of algebra that in applying the results of an analysis, we must use **exactly** the same definitions as were used in deriving those results. Thus it is incorrect to assume that x/t and x'/t' can take on values other than C in applying the LT.

While some derivation may not state (1-5) explicitly, **all must** assume that C is the same in any IFR. It is essential to understand that C is **not a dimensionless numerical constant: C is a velocity; it is meaningless except in its relationship to the spatial and temporal dimensions. C is the ratio x/t; C is the ratio x'/t'. Only C, no other velocity, is involved in any derivation of the LT (noting that S = ßC); this fact mandates that (1-5) are the sole relationships between x and t, and between x' and t'. These relationships cannot be ignored. The LT is not complete until they are substituted into (1-1) and (1-2).** The results are:

(1-1a) $x' = x\sqrt{[(C+S)/(C-S)]} = x\sqrt{[(1+ß)/(1-ß)]}$

(1-2a) $t' = t\sqrt{[(C+S)/(C-S)]} = t\sqrt{[(1+ß)/(1-ß)]}$

where $ß = S/C$

Equations (1-1a) and (1-2a) are the Completed Lorentz Transformation.

They are very different from (1-1) and (1-2). They tell us that:

* both x' and t' increase with S only when S is positive, that is, when the two IFRs are moving apart, and

* both x' and t' decrease with S when S is negative, that is, when the two IFRs are moving closer, and

* x'/x always equals t'/t, and

* x'/t' always equals x/t.

Equation (1-2a) eliminates the well-known "twins" or "clocks" paradox (which, additionally, is based on an improper application of even the incomplete LT).

Equation (1-2a) is identical with the conventional relativistic Doppler shift equation for the period of an electromagnetic wave emitted by a source that is moving away from an observer at velocity S:

$$Td = Ts\sqrt{[(1+\beta)/(1-\beta)]}$$

where Ts is the period of the wave as measured at the source, and Td is the period measured by the observer. The Doppler shift situation is in complete accord with the physical premises of the LT: an electromagnetic wave is moving at C relative to an IFR (its source), which is moving at S relative to the observer's IFR.

Equation (1-1a) also coincides with the conventional Doppler shift equation, recognizing that x' corresponds to the wavelength of an electromagnetic wave emitted by a source that is moving away from an observer at velocity S. x' is the wavelength as measured by the observer; x is the wavelength as measured at the source.

Careful consideration of the various rigorous derivations of the LT make it apparent that, contrary to the conventional view, the LT applies **only** to observations of something moving at C relative to the IFR being observed, which is, in turn, moving at S relative to the observer's IFR. **It is improper to apply the LT to other situations**, as has been done in two purported "proofs" of Special Relativity. The only known real-world situation which conforms to this requirement is that in which electromagnetic waves (including light) are Doppler-shifted. In that situation, the EM waves are moving at C relative to their source (the IFR being observed) which is, in turn, in motion at speed S relative to the observer's IFR. Thus the LT is useful to our current science only for predicting the Doppler shift of electromagnetic waves.

If we attempt to derive (1-3) by dividing (1-1a) by (1-2a), or, as some insist, through the use of differential calculus, we obtain:

(1-3a) $$x'/t' = x/t$$

and since x = Ct:

$$x'/t' = C$$

which is the defined value, and the sole valid value, of x'/t'. It is the **only** value consistent with any derivation of the LT. It is not possible to derive a velocity transformation equation from the completed LT. This is not surprising because the LT is predicated solely on one velocity: C; and solely on one relationship between x and t: x/t=C.

Equation (1-4) can be derived only through the application of the invalid (1-3). It cannot be obtained by application of (1-3a), thus (1-4) is spurious and is not a valid extension of the **Completed** LT.

It is possible to derive a Lorentz-like transformation that applies to velocities [illegible] we have to do, using any of the various derivations procedures, is start off by setting:

$$x/t = V = x'/t'$$

and (1-1a) and (1-2a) become:

(1-1b) $x' = x\sqrt{[(V+S)/(V-S)]} = x\sqrt{[[(x/t)+S]/[(x/t)-S]}$
(1-2b) $t' = t\sqrt{[(V+S)/(V-S)]} = t\sqrt{[[(x/t)+S]/[(x/t)-S]}$

which are the **General Form of the Completed** Lorentz Transformation.

It must nevertheless be scrupulously observed that V is a velocity relative to an IFR that is, in turn, moving at S relative to the observer's IFR. Further, x' and t' may be determined only simultaneously, using simultaneous values of x and t, conforming to $x/t = V$.

CONCLUSIONS

The conventional Lorentz Transformation is incomplete; it neglects the basic premise of its derivation that $x/t=C=x'/t'$.

When completed, the Lorentz Transformation invalidates the conventional Velocity and Mass Transformation equations.

The Lorentz Transformation is applicable to only a single known real-world physical situation: the motion of EM waves relative to a source which is in constant linear motion relative to an observer.

The **Completed** Lorentz Transformation involves no "paradoxes" or conflicts with "common sense".

The **Completed** Lorentz Transformation does **not** tell us that it is forever impossible for us to travel through space at speeds in excess of C. It imposes no limit on the speed of a real body relative to any other thing.

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DOES THE FUTURE EXIST?

Many stories have been written about time travel, telling us about the invention of machines that permit people to travel into the past or into the future. The future in these stories is wonderful or disastrous or strange, sometimes exciting, sometimes even boring, depending on the author's imagination.

Will it ever be possible to travel into the future? Maybe, if the future is a "place" in time that really exists.

But is it?

How can we ever know?

There are some things whose behavior **now** depends on their behavior in the **future**! They are not things that most people encounter in their daily lives, but some of us deal with them quite often. I doubt that any of those people ever think of these things as possible predictors of whether or not the future exists.

What are these unusual things?

Electromagnetic (EM) waves.

Electrical and electronics engineers often work with them. Indeed, some work with EM waves every day.

EM waves are electric and magnetic fields whose intensities vary with time, usually in a regular, predictable way. They are perceived by us as light and heat, and we use them in radio and TV transmission. An electronics engineers can "see" EM waves using an instrument called an Oscilloscope. In their ideal, perfect form, EM waves on an Oscilloscope screen appear as a continuously-repeated **sine-wave**. The **frequency** (f) of the wave is the number of exactly complete sine-waves it makes in one second.

Often, EM waves have less-perfect wave-forms, whose exact shape may be very different from the smooth, perfect sine-wave. Indeed, their wave-shape may even appear discontinuous. It turns out however, that **any** wave-shape that has a repeating pattern is the **sum** of a **set** of perfect sine-waves, whose frequencies are exact integral multiples of the lowest frequency wave present. The lowest frequency is called the "fundamental", and the other waves of the set are called "harmonics". If F is the frequency of the lowest-frequency wave, the harmonics have frequencies 2F, 3F, 4F, 5F, and so on, to infinity. The amount of each harmonic wave present depends on the amount that the overall wave departs from the perfect sine-wave shape.

Electronics engineers have another instrument, called a Wave Analyzer, that can measure the amount of each harmonic present in any wave.

Theoretically, only a wave which continues forever can have a **perfect** sine-wave shape, containing absolutely no harmonics. If we have a source of EM waves (an instrument electronics engineers

call a Signal Generator), it can not, no matter how perfectly made, produce absolutely perfect sine-waves, unless, once turned on it produces waves of exactly the same amplitude and frequency, forever.

Also theoretically, if the Signal Generator is turned on, and will be turned off some time in the future, the amount of each harmonic wave we will measure now will depend on how long the wave will continue to exist in the future. The harmonic content of all of the waves in the series will depend on the total duration of a continuous series of such waves. A series of waves that is turned on and off has a different harmonic content than one that is not. One that is turned on and off periodically, say 1000 times a second, has a different harmonic content than one that is turned on and off at some different rate.

The longer the total duration of a continuous series of waves compared to their frequency, the smaller will be the magnitude of the harmonics arising from their future cessation.

This implies that if we had a sufficiently sensitive and accurate Wave Analyzer, we could determine whether or not a very precisely generated and stable series of EM waves will continue to exist in the future, and for how long.

Measurements made on very short pulses of EM waves imply that the future does exist, at least to the order of fractional billionths of a second.

Do we have Wave Analyzers sufficiently sensitive and accurate to make measurements that may indicate the existence of a more "distant" future? I don't know. I doubt it, as the magnitude of harmonic content that would arise from cessation of the wave-series at a time significantly in the future would be very small. Indeed, it may be below the level of random fluctuations ("noise") always eventually encountered in electrical measurements, or, possibly, it may be one of the causes of that noise.

If such measurements could be performed, they would tell us if the future exists. If we were to find it does exist, that would mean that the future is determinate, because such a measurement would mandate that the wave-series end at an exact, specific time in the future.

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THE CURVATURE OF SPACETIME

We often read that Einstein's Theory of General Relativity is premised on, and proves, that space and time may be "curved". This idea has led many writers on such subjects to tell us that spacetime is actually curved, that if we were to be able to travel for a very long time in the same direction through empty space, we would eventually return to our starting point. This might be true, but only if we live in a universe that conforms to one rather simple model.

What does "curved" space or "curved" time actually mean? The concept is rarely explained, but it is based on a simple idea: the length of a meter and the duration of a second may be found **not** to be the same, everywhere and everywhen, if they could be compared with some arbitrary fixed standards of length and duration. According to General Relativity, the length of a meter and the duration of a second are altered in spacetime by the presence of any mass. The closer to the center of a mass, the longer both the meter and the second become. Unlike Special Relativity, where dimensional changes arising from relative velocity may be illusory, the changes postulated by General Relativity are real, physical changes.

Suppose we were able to compare the length of a meter and the duration of a second, measured at a series of points successively approaching a mass. Then suppose we could compare those measurements with a "standard meter" and a "standard second" measured at some point far distant from that mass. (Note: it is not physically possible to make such comparisons directly). Then, using ordinary rectangular-coordinate graph paper, suppose we plot the length of the meter at each point, compared with the standard, versus the distance of each point from the center of the mass. When we connect all of the points on our graph, we find that the result is not a straight line, but a "curved" line. This is the basic meaning of "curved space". If we drew a similar graph comparing the duration of a second at each point as compared with the duration of a "standard" second, we would obtain a similar curved line. This is the basic meaning of "curved time". Einstein told us (well, usually, but not always) that the length of a meter and the duration of a second at any point in empty

spacetime will always be such that light will travel at exactly C (about 300,000,000 meters/sec). The length of a meter cannot change without an exactly compensating change in the duration of a second. If space is curved, so must time be curved. This is the basic meaning of "curved spacetime".

While it may not be immediately obvious why, General Relativity tells us that it is the curvature of spacetime by a mass which produces the acceleration toward the center of that mass which we call "gravity".

How did Einstein conclude that mass affects the length of the meter and the duration of a second, and therefore alters the geometry of spacetime? It seems that he simply postulated it to be so, and developed a mathematical relationship between the gravitational potential of mass and the four vector dimensions of spacetime (three of space and one of time). Because of the great complexity of the mathematics involved, he based his derivation on a very simple model of a "gravitating body": a mass consisting of a perfectly uniform sphere of a perfect fluid, all alone in empty spacetime. His result was a set of sixteen simultaneous tensor equations which were first solved by Schwarzschild in 1916.

Based on his own logic and Schwarzschild's solution, Einstein calculated the magnitudes of three potentially-observable effects of curved spacetime: a) the curvature of the path of a ray of light as it passes close to a very massive object such as our sun; b) the rate of rotation of the major axis of the orbit of Mercury; c) the redshift of the spectra of light emitted by atoms located in intense gravitational fields. These effects are all miniscule, but Einstein's predictions have been proven accurate by observation, at least in cases a and b. Scientists are even now planning ever more sensitive and accurate experiments in an effort to determine whether or not Einstein's General Relativity equations are entirely correct. To me, the real mystery remains: why and how does a mass affect the geometry of spacetime? Einstein did not offer any explanation.

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29 Mar 93

Rick Rosner, Editor
Noesis
5139 Balboa Blvd
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Dear Rick,

Many thanks for sending the Langan CTMU papers, and for publishing VELOCITY IN SPECIAL RELATIVITY and TIME IN SPECIAL RELATIVITY!

Enclosed is the latest version of COMPLETING THE LORENTZ TRANSFORMATION. It differs from the original only in clarifications that my correspondents have suggested. If I am right (and, naturally, I think I am), this article demonstrates that Special Relativity is fiction.

I do make the effort to read everything published in NOESIS, even though some of it is of little interest to me. I have sometimes discovered interesting new viewpoints in reading otherwise uninteresting materials, or even in reading articles with which I fundamentally disagree.

Also enclosed is DOES THE FUTURE EXIST? which may put a different twist on the question of determinism vs non-determinism, and THE CURVATURE OF SPACETIME, which explains what that concept really means.

Keep up the good work!

Robert J. Hannon