Exploring the Conceptual Frontiers of General Relativity:

Gravity is the Fourth Dimension

by Ron Unger

Introduction:

"All motion is relative." Those four words represent the essence of Einstein's theories of relativity, both special and general. Now, sixty years after Einstein proposed his theories, it is widely assumed that at least physicists understand what it means for all motion to be relative. But I would like to propose that they don't, and that not even Einstein fully understood. This proposal is outrageous, of course, because I am not even a physicist, not an "expert", but I must ask the reader to suspend premature judgement and to simply read this essay. All of the arguements are simple and non-technical. The picture they draw, however, is astonishing, revolutionary, and important. This picture is worth seeing, even if you later decide to reject it: it's not everyday you hear it logically proposed that the earth is rising up under our feet, and that everyone is much bigger today than they were yesterday.

"Why could it not be as true to say that the earth falls up to meet things in the sky as that things in the sky fall down to earth? Is not that simple relativity? Or am I too full of apple juice?

"It is relativity - yes, he [Einstein, as Murchie imagines him] checked himself. But perhaps it is not so very simple. For although the apple is regardable as accelerating downward, can one ....could on possibly justify a claim that the earth is accelerating upward just as much?

"on the face of it, upward terrestial acceleration would seem impossible for more than a small portion of the earth, since upward, globally speaking, is not one direction but every direction. In fact, if the earth's surface is accelerating upward all around the earth, the earth as a whole must be exploding, which it obviously is not." Guy Murchie, p. 563, Music of the Spheres.

Obviously the earth doesn't explode. Neither, obviously, does it spin, nor does it orbit around the sun. Just as Copernicus was the first person to be too stupid to not notice that the earth doesn't spin or orbit, so Kent Robertson was the first to not notice that the earth doesn't explode. He wrote a book called The New Gravity in which he claimed, in brief, that nothing falls, and that things only seem to fall because bodies such as the earth expand outward at an accelerating rate and collide with them. We don't notice this as expansion because we (and every other bit of matter) are expanding at a proportional rate, and so our tape measures grow along with everything else. He then pointed out that gravity can best be conceptualized as a movement along the fourth dimension, since a three dimensional object moving at right angles to itself can best be pictured as expanding or contracting (refer to first illustration). Or, as Kent worded it, gravity is the fourth dimension. He followed up on that by conceptualizing electricity

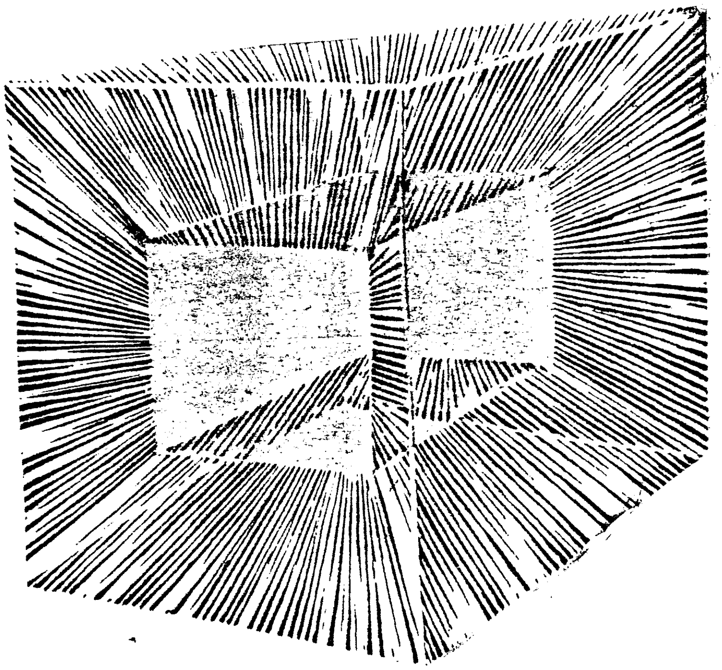


illustration by Anthony Ravielli, as taken from The Relativity Explosion by Martin Gardner.

as the fifth dimension and magnetism as the sixth dimension, an idea which will also be discussed in this essay.

It was startling to have anyone make such claims, and even more startling to have that someone be a person who hadn't even gone to high school. It was too startling for people to believe, so, unfortunately, they didn't. Kent has been ignored. As I discussed Kent's ideas with others, I found another reason his ideas were being ignored: they failed to explain certain details they should have explained, and they were inconsistent in certain respects. In the present essay I have modified the ideas, often radically, to remove most of those flaws. For reasons of space I do not present Kent's ideas in their original form, so the essay is a mixture of his ideas and my variations on them, which can be seperated someday by others if these ideas are recognized as being important enough to worry about who was responsible for what.

The most critical problem I had with Kent's theory was the way it seemed to be unrelativistic: instead of the apple falling the earth rose. To be really relativistic it seemed to me a person would have to be able to adopt either viewpoint as desired, and in this essay I have tried to show how that can be done. It requires our perception to flip/flop in some very strange ways, but all in all I think it is good practice, as we are finding that most issues in science seem to involve two ways of visualizing the same reality, like the wave/particle complementarity. This essay is not meant to contradict Einstein. He understood how gravity works in a mathematical, abstract sense, and the ability of his equations to cover gravitational phenomena has never been successfully questioned. But to reach a deep understanding of something it is necessary to conceptualize it in the simplest terms possible, and I don't feel that "bent space" ideas are the simplest way to conceptualize gravity. Einstein himself believed that his theory of relativity was essentially philosophical and conceptual: he is even quoted as having said that "since the mathematicians have invaded the theory of relativity I don't understand it myself anymore." (p. 548 Music of the Spheres by Guy Murchie.) This essay only aims to expand the philosophy of relativity a little, or perhaps a lot, in hope that the resulting insights will be of value for future explorations. No math is used in this essay, because it does not concern the facts about gravity but only the general conceptualizations used to cover those facts.

This presentation will probably not resolve all of the reader's questions about this theory. There is a question/answer section at the end, but even that leaves many questions unasked and unanswered. Anyone with further questions s/he would like to have me attempt to answer, or anyone who feels s/he has something to contribute, should write to me a ~~395 E. 30th Ave.~~ 1770 Augusta, Eugene, OR 9740~~5~~3 This is a revolutionary theory not just because of what it proposes but because of the way it has been proposed: by persons completely outside of the academic speciality which is supposed to hold all the answers on the topic. I offer the reader the opportunity to join in this revolutionary activity, to evaluate and contribute her or his thinking to this subject in the absence of official guidlines on what should be thought. (This theory, with my revisions, has never been presented prior to this paper, and is completely unknown.)

My thanks to Kent Robertson, who discovered the concept that "gravity is the fourth dimension" and who got all this started. Also thanks to Rick Bennish, who like me has pursued these ideas and who, through various conversations in which he often disagreed with me, has helped me clarify my thinking.

Part I:

Usually when we fall, we don't fall for a sufficient distance to really contemplate what we are feeling. People who skydive do get the chance: it is a feeling of weightlessness like astronauts have, though it is somewhat disturbed by the air rushing up past them. On the other hand, the feeling we have while in contact with the earth's surface is also something we contemplate very little, because it is so familiar as to escape notice. To understand that feeling it is useful to note what would mimic it. Einstein used the example of an elevator, weightless in outer space, that is being reeled in at an accelerating rate by some giant fishing reel. So while we stand on the earth the feelings we get are as if we are being pushed upwards at an accelerating rate: and the feelings we get while we are "falling" are as if we are resting weightlessly in space. All these "as if's" were too much for Kent Robertson.

He soon found a deeper reason for believing that the earth, and all matter, was expanding. For almost a century we've known that mass or matter is composed of "energy". But ordinary fields of energy expand without limit. Einstein for example was severely hindered in developing a "unified field theory" by his inability to discern what would keep the electromagnetic field of a particle "within" that particle, what would keep it from spreading indefinitely. When it was first discovered that particles seemed to be "patterns of disturbance" or "waves" this seemed to be impossible, because of the tendency of waves to spread outward from their source and to disperse infinitely. This problem was never solved: it was simply decided that they were waves that in some senses weren't waves, or "wavicles" as they have sometimes been called. But perhaps, Kent Robertson thought, they were waves that did spread outwards, and that this "spreading" had only been noticed previously as gravity.

Einstein regarded gravity as a function of the curvature of space. The function of this "curving" is mostly to transport objects towards the surface of other objects; "It is as if the mass had grabbed hold of space and pulled the space into it." (Dr. Robert L. Forward, "Goodbye Gravity" in "Omni"). But this is a very unusual line of thinking, with space moving things around, or even objects rearranging spaces without moving themselves. In our usual conception of things, things move and affect other things, and spaces are affected only indirectly, as the space between myself and downtown shrinks when I drive downtown. Space is that which provides a definition for objects, or, conversely, objects are that which define spaces (like when we build walls to define a room). Since this is true, it is of questionable validity to say that a space can move while an object does not, or vice versa. How could a room shrink without the walls moving, or the walls move without affecting the space? In the same sense, Einstein's "bent space" can equally be visualized as "bent matter" which is expanding in the same sense as the "bent space" was contracting into the matter. These are just two descriptions of the same motion: neither has any scientific superiority. But to be stuck with one view and unable to see the other is a clear disadvantage, plus, the expanding matter model is more interesting from several perspectives. But understanding that model requires changing other basic conceptualizations, which might seem confusing, though only until the concepts are well understood.

Up till now, we have seemed to consider gravity as being completely explained by the accelerating expansion outwards of matter, and its subsequent collision with other matter. But that model fails to explain one of the most obvious facts about gravity, namely, that things further from a gravitating body are less affected by it than those nearer. Ordinarily, if we were to imagine the earth increasing its radius by two miles, then its surface would be two miles closer to an object that was initially 2,ooo miles away as well as two miles closer to an object which was initially 3 miles away. But during the time in which an object initially 3 miles away "falls" 2 miles, an object initially 2,000 miles away "falls" much less than that. Newton explained this by saying that the strength of gravity decreases with increased distance according to an inverse square law: Einstein explained it by saying that the space is most "bent" closest to a gravitating object and less bent further away. It could also be explained by a theory exactly the opposite of Newton's, where gravity <u>increases</u> with increased distance - if you assume that gravity is a repulsive instead of an attractive force.

It helps to imagine for a bit Newton's theory turned inside out. Gravity would then be a repulsive force which increases with increased distance, also according to an inverse square law. As the atoms of the earth expand, the earth itself expands, because interatomic forces (which are also expanding) tend to keep each atom at the same proportionate distance from every other one. A baseball flying overhead would be somewhat repulsed by the overall repulsive force of the earth's gravity, but it would be so close to the earth that the expansion of the earth would quickly overtake it. For something further away - the moon - the repulsive force of the earth would be much stronger. The earth's surface would approach the baseball 16 feet in the first second after being dropped. The moon, if it wasn't orbiting, would move away from the center of the earth to the extent that the earth's surface would only be 1/20th of an inch closer to the moon after 1 second. In Newton's theory, the centrifugal force of the moon's orbit exactly compensates for the earth's "pull", and so the moon doesn't fall. The inverse would be that the moon's centrifugal force plus the earth's gravitational push would prevent a collision. The moon' orbit then would be, instead of an ellipse, an elliptical expanding spiral around a growing earth.

The theory, as developed thus far, works fine as long as one is considering objects with masses which vary proportionately with their size. It needs further development however to deal with objects with similiar size but varying mass. For example, let us consider the gravitational properties of a hollow aluminum sphere of roughly the same size as the earth. We know that stable objects of varying masses retain the same proportionate size over time. So, if we are claiming that the earth expands, we must also claim that the hollow aluminum sphere expands in equal proportions to it. But then it should also be very good at expanding outwards and colliding with objects, even better than earth, if one assumes that its lower mass would mean it has a weaker repulsive force going outward from it. However, this is the opposite of what we know would occur: we know that the relative distance between a baseball and the aluminum sphere would hardly change at all over one second, while the earth and the same baseball would move 16 feet closer together, assuming the baseball was released 100 feet above both surfaces.

The problem comes from performing insufficient inversions. It was too easy to think that more mass would mean more repulsive force: but to really invert Newton's gravity we have to assume that more repulsive force is a product of less mass. Therefore, while the hollow aluminum sphere expands as much as the earth, it tends to push the baseball away as quickly as it expands (with the difference being a small fraction of an inch). However, the repulsive force of this sphere would increase very little with increased distance: at 2,000 miles away from the sphere it would be very difficult to notice the difference in the amount the baseball would fall. So apparently it follows that what varies positively with mass is not repulsion but rather the lessening of repulsion: a more massive object exerts a weaker repulsion on other objects at near distances, though this failure tends to disappear over longer distances.

To sum up: gravity is a repulsive force, inversely proportional to mass. In other words, it is most active in "empty space". In the presence of mass, this repulsive force, or expansive effect, decreases according to an inverse square law as one approaches a massive object. The result is that expansion is normal, everything is expanding, and it is only in the vicinity of massive objects that space fails to expand. Massive objects themselves however tend to expand at a rate proportional to that of empty space, because of interatomic forces.

At this point, the theory may seem clumsy or unnecessary, with everything expanding in such a surprising way: but the alternative, when examined clearly, is no more coherent or simple. Also, the above theory is no replacement for gravitational theories that have gone before, but is only their flip side which has always been implicit in them. To thouroughly understand gravity it is necessary to be able to "flip" from one theoretical expression to the other, just as to understand ordinary accelerated motions relativistically it was necessary to express their motions according to two conceptual "theories".

The first theory of accelerated motion is the common-sense one: when I get in my rocketship and accelerate to ½ the speed of light, it is conceptualized, simply, that I am moving and that the resistance my rocket motors encounter is called "inertia" and is felt whenever on tries to accelerate relative to the rest of the matter in the universe. But there is an apparent problem here for relativity: if my "inertia" is a measure of whether or not I am accelerating

How Gravity varies with mass and distance:

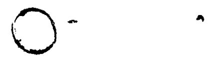
for a hollow aluminum sphere, the same size as earth:

Moment A

Moment B

Space between sphere and object stays just about proportional to size of each object, and there is little difference over distance.

for earth:

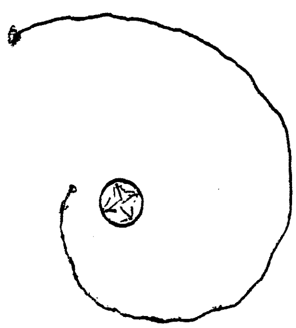


Moment A

Moment B

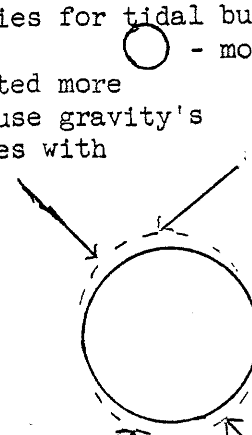
Space between earth and nearby object expands proportionately much less that the expansion of earth and apple. Space between more distant object and earth expands more nearly proportional to the expansion of earth and the object.

Spiral orbits:



Orbital path expands along with objects.

Two theories for tidal bulges:



- moon

water attracted more to moon because gravity's pull increases with nearness:

water left behind when moon pushes earth away:

- earth

water left behind when moon attracts earth:

water pushed away from earth, because the moon's push increases with distance:

Generalizations:

Everything which appears to stay the same size is actually expanding. Everything which doesn't fall is actually moving away.

Everything which appears to fall is just holding still, or just not moving away as fast as everything else.

Gravity is a negative curvature of space which is inversely proportional to mass and which lessens with increased nearness to mass. At least that's one way of saying it.

relative to the rest of the universe, then acceleration can be measured absolutely. All a person would have to do to see if something were accelerating would be to see if it were showing inertial effects. But Einstein showed that there was an alternative conception of what was happening: in it all the galaxies begin moving in a gravitational field, and I am required to turn on my rocket motors in order to resist this gravitational field. I am no longer experiencing "inertial" effects, instead, I am experiencing the tug of a gravitational field! This is the fameous equivalence principle of gravity and inertia. In this way it is proven that there is no way to determine which is moving, my rocket or everything else.

In the above example, it should be noted that the gravitational field in which everything but the rocket "falls" is not the same as that found around massive objects, because it is the same everywhere and doesn't vary according to the distance from an object or anything. It is in regards to these two different kinds of gravitational fields that Einstein said:

"Now we might easily suppose that the existence of a gravitational field is always only an apparent one. We might also think that, regardless of the kind of gravitational field which may be present, we could always choose another frame of reference such that no gravitational field exists with reference to it. This is by no means true for all gravitational fields but only for those of quite special form. It is, for instance, impossible to choose a body of reference such that, as judged from it, the gravitational field of the earth (in its entirety) vanishes." (Albert Einstein, as quoted by Tauber in Albert Einstein's General Theory of Relativity.)

Einstein is saying that we cannot imagine that the apple is holding still (like the stars in the rocketship example) while the earth moves toward them, because of things like the way gravity varies with distance. It was this that caused people to dismiss any consideration of the earth, and other matter, expanding. But, as far as I know, the view of the apple standing still, the earth expanding, and a reversed gravity field, or negative curvature, has never been considered. Because of this "general relativity" has been amazingly unrelativistic, at least in the way it has usually been presented and in the minds of most people. (Einstein, if he entertained conceptions such as those in this essay, did not share them publicly, and so the ideas are definitely "new". Ask your neighborhood physicist if he's heard about a way of conceptualizing gravity as a negative curvature that varies inversely with mass.)

Let us review the standard conceptions of gravity as they exist today. First of all, physical objects neither expand nor contract over time, except as resulting from some immediate physical process other than gravity or in the extreme conditions found on white dwarfs, neutron stars, etc. However, in the vicinity of massive objects space is seriously affected: it becomes "bent" or "curved" and objects suspended in that space begin moving, at ever increasing rates, towards the massive object along a pathway called a "geodesic". Since there is always apparently the same amount of space above the earth, it is difficult to visualize how the space bends inward: does the space around an apple actually carry the apple inward toward earth, while other space is created to fill the gap between the earth and the moon? Why does the universe appear to maintain the same size (or even to grow) if it is always locally contracting around massive objects? Or does the space the apple is in somehow bend in such a way as to dump the apple into a lower space? That view begs the question, since it is necessary to visualize a force of gravity that makes an apple fall into a lower space when dumped out of a higher one. The point of all this is that the traditional conceptions of gravity derived from general relativity are far from perfectly clear, and this lack of clarity is in addition to the problem of not being sufficiently relativistic (because only the falling object can be visualized as moving).

Overall, the "reversed theory of gravity) usually lacks clarity only where the traditional conceptions of gravity lack clarity, or at least where I fail to understand them clearly enough. To the extent that gravity is clearly understood according to one visualization, that understanding converts to the other visualization when properly reversed. For example, though space is viewed as being "bent" near gravitating objects, and though even light is bent by those fields, the size and shape of an apple is the same on the earth as on the moon, even though gravity is 6 times as strong on the earth as it is on the moon. In other words, if gravity can bend light why can't it bend atoms? Whatever the precise explanation for this is, it could be converted (in the expanding model) to an explanation of why the apple on earth expands at the same rate as an apple on the hollow aluminum sphere, even though there is much more expansion going on nearby the hollow sphere. The reader should try to understand the theory further by using this process of reversal whan necessary.

Besides presenting the flip side of gravity (which he considered to be the <u>real</u> side) Kent Robertson also identified gravity with the fourth dimension. The first three dimensions are easily defined geometrically. Calling time the fourth dimension, as most scientists currently do, and then failing to define the fourth dimension geometrically, appears to have been an unfortunate decision. Traditionally, each dimension has been defined geometrically as being that which is off at right angles from the preceeding dimension. A point (see illustrations below) is recognized as the zero dimension. Moving it at right angles to itself produces a line. Moving the line at right angles to itself produces a plane. Moving a cube at right angles to itself produces a solid, three-dimensional figure such as a cube. Moving that cube at right angles to itself produces a hypercube, such as the one illustrated on the second page of this essay. Strangely enough though, this method of defining the fourth dimension has been completely given up as being meaningless; for no one can see how it fits in with anything, and time does not seem to scientists to have a geometrical definition.

But some sense can be made of the hypercube after all. It can easily be visualized to be an omnidirectionally expanding cube, and from what has come before it is easy to see that this omnidirectional expansion is gravity. Consequently, Kent Robertson proposed that gravity/inertia, not time, is the fourth dimension. He further proposed that there were two more dimensions which, like gravity, involved time but were not simply time.

Before I get to that, one might ask a question concerning why one couldn't visualize the hypercube as being a contracting cube, or something to that effect. They might do so, but gravity can be visualized as a contraction of space around matter and this in itself would follow a four dimensional pattern. So this definition of gravity is independent of which way gravity is being visualized or which way one is looking at the hypercube.

Kent Robertson noticed that electricity comes at right angles from mass/matter: he saw that this meant it was coming at right angles from the fourth dimension. So he declared electricity to be the fifth dimension, and magnetism, which comes at right angles out of an electrical field, he declared to be the

0 dimension: lrst dimension: second dimension: third dimension:

sixth dimension. (The notion that electricity involves the fifth dimension had been proposed before: Theodore Kaluza and Oscar Klein developed a theory in which the charge of a particle was determined by "which way it went" in the fifth dimension. This theory was not found to be acceptable, but it may have been substantially correct while wrong in some details.) While I cannot "prove" or even forcefully support Kent's electromagnetic speculations I find them highly interesting, and probably true. They form a strong pattern, though more work would be required to clarify all their aspects. Take note that there are now three time - like dimensions: the startling implications of these three dimensions of time will be discussed in the following section.

Part II:

The substance of the theory, and the arguement for it, have now been presented. If the reader still has questions about how the theory works, s/he should consult the question/answer section at the back, or try rereading the first part of the essay, before continuing. The section which follows concerns the usefulness of the theory, its implications, and some general thoughts regarding it.

It may seem to some that the only purpose of this theory is to confuse the reader, to turn her or his conceptualizations inside out and to make a muddle of something which is already sufficiently well understood. It is true that this theory has nothing to add to the mathematical predictions of general relativity theory as to how physical objects behave: but it offers what I feel is a much-needed alternative conceptualization of the phenomena which general relativity predicts. The theory of general relativity is not just a theory of gravity: it is a theory which initially attempted to show that accelerated motion is relative, or more specifically, that any object we consider to be accelerating can be considered to be motionless while everything else "falls" at an accelerating rate in a "gravitational field". The converse, that anything which falls in a gravitational field can be considered to be still while something else accelerates towards it (or that something which does not "fall" in a gravitational field, such as a man standing on earth, is actually accelerating), was not claimed by Einstein, but I believe it is critical to fulfill the original intention of general relativity. So that is the first purpose fulfilled by this theory: general relativity theory becomes truly relativistic.

The theory clarifies in an important way our conception of the difference between something which is accelerating, like a rocket, and something which is falling in a gravitational field. Acceleration is a change in velocity over time. Since accleration is relative, we should always be able to point to any specific object and say it is still while others move, but the description changes depending on what we call "moving" and what we call "still". When the rocket turns on its engines in can be conceptualized as moving or as resisting the gravitational field that everything else is falling in, but in either case it is aboard the rocket, not on everything else, that one can <u>feel</u> that something is happening When something falls, we can either say that it accelerates down in a gravitational field or that the earth (or whatever) accelerates up to it: but in either case you have to be on earth to feel something happening. The falling object feels only the same weightlessness any object would feel suspended in space with no gravitational field (or at least it feels this way until the earth hits it). The situation on earth is like that on the rocketship, where one can either speculate that oneself is accelerating or that oneself is resisting falling in a gravitational field that everything else is falling in: in either case it is oneself that feels the acceleration or inertia. Too often writers on general relativity simply claim that "gravity is acceleration", leaving the reader to conclude that the falling apple is equivalent to the accelerating rocketship, when it is really more equivalent to the stars which "fall in a gravitational field" whenever a rocketship moves.

Overall this theory is an excellent exercise for the imagination. After studying this theory for years I have become much more adept at seeing when two apparently contrary views describe the same reality. Alternative theories are sometimes like different fingers pointing at the moon: the fingers are different but the moon is the same. But the different fingers represent different angles of looking; if we fix our vision to one perspective, if we always look at the mountain out of the same window, we miss a lot. Once we start changing our perspectives, experimenting with different theories, then we realize how much of what we thought was the world was just a limited picture of it based on our perspective, and we realize how truly mysterious and awesome the universe is.

I repeat that this theory is not an alternative to the mathematics of general relativity theory: it is only a different interpretation of that theory. Some people have noted that Einstein's theories were really a search for invariants, or factors like "interval" which are the same no matter what you think is moving and what is not. This means that Einstein was just trying to describe the relationship, without labeling one side of the relationship as active and the other as passive. As an analogy we can take a husband and wife who come to a marriage counselor, each claiming that the other has been disagreeable. If the marriage counselor has a fixed scheme of values, that is, if he believes that husbands should act in such and such a way and that wives should act in such and such a way, then he can determine who is upsetting the harmony of the relationship. This fixed scheme of values is like the absolute frame of reference which physicists once hoped to find which would allow them to determine whether or not something was moving. If the marriage counselor has no fixed scheme of values however, he will simply observe a relative disturbance in the relationship, which is invariant, meaning it is visible from whatever scheme of values a person chooses to use. The marriage counselor can further determine that the disagreement could be ended by the relative movement of the two towards agreement, but whether a particular one of them or both should change he could not say. At best, he would clarify their choices and show that there was no blame. Einstein's theory of relativity,in its pure form, does not place "blame" for the apple falling on either earth or the apple, but it is usually interpreted as blaming the apple since it initially seems so crazy to blame our good solid earth. But it was necessary to see how we could blame the earth before we could reach a nuetral view and see how any particular picture is dependent on our perspective.

(A note on the above analogy: it is considered heresy to see the relativity of motion as being analogous to the relativity of values, but the analogy is there for anyone to see.)

The most important contribution of this new theory however involves its most outrageous aspects The theory allows us to visualize what the energy that is matter "does" - it expands - and then we can visualize something that nobody ever could before, which is where the past has gone. It is rather simple really - the past is inside of everything! The past of the oak tree is within the oak tree, the past of the earth is within the earth, etc. It is no minor thing to find that time as well as space can be explored by geometry.

Now, looking back, it seems strange that people accepted "time" as the fourth dimension, and yet weren't then interested in exploring the geometry of time, even though all the other dimensions were geometrical. Until Kent's theory, the geometrical conceptions of the fourth dimension have been left in a vacuum, since the notion that time was the fourth dimension seemed to conflict with any geometrical interpretation. The synthesis of the "time" and the "geometrical" interpretation of the fourth dimension is begun in this essay. There is certainly much more to it than what I will be able to cover, but I will picture some aspects of a world view based on this idea.

One of the most surprising ideas to come out of this is that time is three dimensional - or perhaps we should say there are three possible dimensions for time to go in - the fifth and sixth dimensions as well as the fourth. There are reasons to believe that the fourth, fifth, and sixth dimensions are a reverse of the first three dimensions. Geometrically this would mean that these second three dimensions would involve a progressive breakdown of the laws and structures possible in the first three dimensions, a kind of anti-geometry. Arthur Young, particularily in his books The Reflexive Universe and Which Way Out explores this idea in some depth, however, he would probably find it more accurate to say that the rules of the first three dimensions are overcome in the second three, rather than broken down. Whatever the exact perspective, it is easy to begin seeing the polarity between the first and second set of dimensions as being the most important determinant of the form of our universe. The possibilities for physics are immense. Physics has been getting more confusing as fewer and fewer of its phenomena can be conceptualized: but bringing in this notion that some of the basic forces have different yet precise dimensionalities might clarify the issues immensely. In order to accomplish that, this theory will have to become widely known, and many persons will be required to fit the puzzle together. Invariably details appear to not fit with this theory, until, as with a jigsaw puzzle, they are turned the right way and the fit is found.

It may seem strange to some that no place has been found in this theory for the "strong force" and the "weak force". They have not been intentionally left out, but I think they may prove to be aspects of the other forces or even somehow a product of the first three dimensions. The strong force and the weak force are unusual in that one must be dealing with something as small as particles to notice them, and because that world is so remote and difficult we may be a long way from understanding the true nature of its forces. There are many speculations concerning those forces, but the following can serve as an example of what may eventually be found to be true. Yuval Ne'eman has been working with a gauge theory in which it appears that gravity at the quantum level is the strongest part of the strong force. He also says that gravity at this level is identified with a 4-volume instead of a metric, however, "We know this is not true in macroscopic space-time." See Yuval Ne'eman's section in the book Albert Einstein's General Theory of Relativity, edited by Gerald Taubor. It would be interesting to see if Yuval Ne'eman would revise his ideas about what gravity can't be in the light of the ideas in this essay. In any case, much work needs to be done in this and related areas.

The ultimate point of understanding physics is to understand ourselves and the facts of our existence. Without going into too much detail here, I can demonstrate one way in which this present theory can change our notion of how reality works. If our past is inside of us, as previously suggested, a person might wonder if they could get in touch with it. To do so one would have to go at right angles to time: but we already know of something which goes at right angles to the first dimension of time, and that is electricity. In some sense, an electrical field may be in contact with all moments at once: and this is especially significant since our brains are known to create electrical fields constantly. Memory has never been localised to one section of the brain: and one alternative to believing that a duplicate copy of each experience is somehow stored in every part of the brain is to believe that somehow the brain directly contacts the past when it "remembers" something. This would also suggest the possibility of "remembering" the future: but perhaps we are built to not do that, or at least to not do it too consciously most of the time. After all, it would disturb the notion that we are creating the future if we could see it already formed before us: we would stop completely and have nowhere to go.

Or it could work somewhat differently. The problem with electrical fields is that they only go at right angles to one dimension of time. What could go at right angles to all three dimensions of time? Proceeding with the same reasoning as previously, there was one possible dimension Kent Robertson missed. There is one thing known to come at right angles out of disturbed electric and magnetic fields, and that is electromagnetic waves. (It is interesting that electromagnetic waves are created by accelerated (gravity is acceleration) electric and magnetic fields - as when an electron is accelerated - this suggests that electromagnetic waves are a product or combination of all the other dimensions.) If the 4rth, 5th, and 6th dimensions are the reverse of the first three, then the 7th is the reverse, or the repeat in a different direction, of the zero dimension. This is particularily significant since relativity theory in many ways visualizes electromagnetic waves as being beyond both space and time. There are many strange things in the history of electromagnetic theory, like the way the mathematical equations seemed to predict that the waves, once created, should go into the past as well as into the future. The brain could use electromagnetic waves for memory: it has been suggested that the brain may use electromagnetic waves of a long wavelength, and low energy. This would be at right angles to all three dimensions of time and would be completely comprehensive.

The expansion of this theory to include 7 dimensions is just an example of the ways it probably can and will be expanded as attention is paid to it. The application of this theory to an understanding of memory was just an example of its possible applications. The possibilities are truly immense: I believe that this theory will be basic to a new comprehensive conception of the universe which is now developing. It is a basic part of what Arthur Young calls the digestion of science: not new facts but new understanding based on an incorporation of those facts. May the reader digest this theory also, and enjoy it as well.

Part III:

1. If we visualize gravity as similar to a repulsive force, or as negative curvature, how can the ocean's tides be explained?

Answer: To explain this we have to realize that there are two tidal bulges which occur on earth simultaneously. One bulge is close to the moon (for simplification we will only use the moon's effect), and is usually visualized as being caused by the moon attracting the ocean water closest to it. The other bulge occurs simultaneously on the reverse side of the earth and is produced when the moon's gravity pulls the earth towards it, causing a "bulge" of water on the far side of the earth to be left behind. The alternative and opposite conceptualization would have the bulge close to the moon be the water left behind when the moon pushed the earth away slightly, and the bulge on the opposite side of the earth be caused by the direct repulsion by the moon on the earth's waters (repulsion would be greater on these more distant waters). The two conceptualizations predict identical effects.

2. As an object falls into a sufficiently strong gravitational field, as that produced by a black hole, it is literally pulled apart as it falls due to the attraction or curvature being greater on the lower portion of the object than on the higher. How can this be explained if the object is not being attracted, and is only sitting in space waiting for something to collide with it?

Answer: If repulsion is greater at greater distance then the upper portion of the object would be pushed more than the lower, resulting in the object being pushed apart instead of pulled apart.

3. If "things don't fall, but the earth expands out and hits them" then why can the attraction between a mountain and a suspended object be measured?

Answer: Since the mountain is an area of high mass, it exerts less repulsive force towards the suspended object than do other parts of the universe do. Consequently the suspended object gets pushed in the direction of the mountain.

4. Why so things which have been falling for a long while fall faster than things which have just started to fall, if they aren't really falling but are just suspended in space waiting for the earth to strike them?

Answer: Let us consider an airplane containing two skydivers. One jumps out, the other waits a few seconds and then also jumps out. If we measured how much each fell in the first second after the second one jumped, it would be determined that the first one to jump "fell" much further in that one second. To understand why, we have to consider what is happening to the airplane and the second skydiver inside it during the few seconds after the first has jumped but before the other jumps. The earth expands at an accelerating rate, pushing its atmosphere, which also expands, out with it. The atmosphere naturally pushes the airplane up with it, thus maintaining the relative distance between airplane and earth. The first skydiver, after he jumps, is still moving away from the earth at the rate which the earth was expanding when he jumped, but since that rate is increasing the earth overtakes him at an increasing rate. The second skydiver, when he jumps, has a greater velocity away from the earth than the first one because he has shared in the increased speed of expansion of earth and its atmosphere. So, what appears to be differing "rates of fall" can always equally be interpreted as different velocities away from earth.

5. Your "flip side of gravity" sounds just like anti-gravity, yet you say it works just like the gravity we conventionally know. What is anti-gravity in terms of your theory?

Answer: "As he approaches the anti-galaxy he will be attracted by anti-gravity. In fact, gravity and anti-gravity are one and the same thing. Here some will disagree, but upon second thought they will find they are wrong." (Edward Teller, a UCB physicist, as quoted by Martin Gardner in Ambidextrous Universe.) It appears that something like my theory may have crossed Mr. Teller's mind, but as far as I know he never bothered to explain anywhere just how and why gravity and anti-gravity are indistinguishable. It is an issue that deserves further consideration.

We have stated that gravity may be considered to be a positive curvature or an attractive force which varies positively with mass, or a negative curvature or a repulsive force which varies inversely with mass. The latter upon first impression is about as much the opposite of the former as seems possible, and so is a very good attempt at describing "antigravity"; yet it does indeed describe only gravity operating as we know it. But we could try a description which is not quite the inverse of either; how about an attractive force which varies inversely with mass? That would function the same as a repulsive force where the repulsion varied positively with mass. In a universe where it was always this way it would mean nothing, for the areas of lessor density would function as the areas of greater density do now, and vice versa. But if someone made this switch overnight, then something would be noticed; it would be anti-gravity as conventionally understood, with things falling upwards and whatnot. Other variations are imaginable. What if gravity was a repulsive force which decreased with increased distance? The converse/equivalent of that would be an attractive force which increased with increased distances; I will leave it to the reader to imagine the consequences of that. As for what kind of gravity anti-matter possesses, I will not attempt to say, nor do I believe it has been conclusively measured. Contrary to Mr. Teller, however, there is the possibility that it could be different from the usual.

6. Since the speed of light is finite, we see things far away as they were in the past. If things were all smaller in the past, shouldn't things look smaller when they are far away than when they are nearby, even more so than predicted by the laws of perpective?

Answer: No such decrease in visible size is to be expected. Areas of empty space and stable physical objects tend to expand at the same rate, and light rays embedded in that space expand in due proportion.

7. Wait, doesn't this imply that light is accelerating and that it doesn't have a fixed velocity?

Answer: Yes, it does imply that light is constantly accelerating, but it is always travelling at 180,000 miles per second according to the definition of 180,000 miles in its vicinity. The exception to this is areas where the overall expansion is lessened by the presence of mass; in the ordinary rhetoric it is stated that light "bends" or is "slowed" by the gravitational field of a massive object. In our alternate theory we just say that light isn't sped up as much, or that it isn't "repulsed" as much, by a more massive object.

8. If things move towards us then the light coming from them is blueshifted (shifted towards the blue end of the spectrum). But if we are sitting in outer space watching the light come from earth that light is redshifted slightly (redshift usually implies an object is moving away from us.) How do you explain this if you propose that the earth is moving towards the outer space person, which should produce a blueshift instead?

Answer: First of all it is important to note that an observer who is on earth looking at light coming towards the earth sees a slight blueshift, not a redshift. I can see two ways of explaining why the light is shifted two different ways depending on its direction relative to a gravitational field. If there is less "push" outward from earth nearby the earth, then incoming light would benefit from having less resistance (and so would be more energetic or blueshifted), and outgoing light would have to work harder since there would be less push assisting it, and so it would be redshifted. Or we could explain the same effect by the prediction of general relativity that time slows down in a gravitational field; in this case the earthbound observer sees incoming light as vibrating faster (bluer) than he would expect since his own clocks are a little slow, and the observer watching the light coming from earth sees it to be vibrating a little slow, or redder, since it has been slowed by the slower time near earth.

9. Why does time slow in a gravitational field?

Answer: If time is expansion then the slower expansion which is a gravitational field is slowed time.

10. If time is expansion, then shouldn't a person who does something to slow

his or her time, like someone who enters into an intense gravitational field or someone who travels near the speed of light, be much shorter than the rest of us when s/he returns to us? Shouldn't even airline pilots eventually become shorter the longer they fly, since their time while they are flying goes slower?

Answer: No, they shouldn't, at least in most of these circumstances. Atoms, and things like airline pilots and other stable pieces of matter, expand at a proportional rate no matter what the field, at least from zero gravity up to about the intensity of the gravitational field of a white dwarf. It is only the "space" that expands less. An observer who ventured to land on a white dwarf would indeed come back shorter, if he could ever arrange to come back. In conventional theory it is said that in the case of a white dwarf the electromagnetic forces of electrons and protons fail to uphold the structure of individual atoms when pulled together by the strong gravitational field of the white dwarf. In the "flipped" theory we would say that the electromagnetic forces ordinarily require a certain "push" of gravity to keep them expanding at proportional rates, and that in the presence of all the mass of the white dwarf this push is diminished to such an extent that the atom cannot keep its electrons and protons apart in the usual manner.

11. What is the overall speed whith which matter is ordinarily expanding? One cubic inch of iron becomes how many cubic inches of iron within one second (using the previous second's cubic inches for a standard)?

Answer: I don't know. I'm not even sure what the criteria are for answering this. It is difficult to compare two seconds since the earlier is never available for the comparison.

12. According to presently existing theories black holes are objects with gravitational fields so strong that not even light can escape. In your theory, the light could not be "falling" into the black hole, since nothing falls, so the singularity of the black hole must expand outward and collide with that light. Yet in order to "catch" a ray of light this singularity would have to be accelerating at the rate of 180,000 miles per second (in other words it would have to be travelling outwards at a rate 180,000 miles per second faster in each second than it was in the second before). How do you explain this?

Answer: I am too confused on this matter to answer it fully, but ther are a few issues relating to the inability of light to escape a black hole in addition to any proposed motion of the singularity. The singularity moves, if it does move, outward relative to the space around it. But that space has special propoerties. A black hole has sufficient mass that the space around it is not expanding at all. We have already said that as expansion lessens, redshift increases; for a black hole (within the photon sphere) redshift would be so great that the light would have no energy at all, it would be redshifted out of existence. Also, this absence of expansion is also an absence of time; so there would be no time for the light to leave the black hole in.

No one is even sure whether black holes exist, and there are numerous theories as to how they behave. I am sure that persons who are good at theorizing about black holes could describe black holes in terms of this "flipped" theory much better than myself, and with equal clarity to the conventional.

13. If this expansion of matter that you propose were a velocity it might be more understandable, since an object with a given velocity tends to maintain that velocity unless interfered with. But you propose that matter is continually accelerating, or continually increasing its velocity outwards: what provides the energy for this?

Answer: I'm not sure I can answer that too well, except to say that there is no better explanation within the conventional theory for where the earth gets the energy to make apples and such "accelerate towards it" year after year. The earth not only doesn't get tired of this, but the more apples it picks up the better it is at catching apples (it has more mass). Indeed, the force of gravity implies that mass is a self-fueling perpetual motion machine. I once heard it suggested that the fourth dimension possesses negative entropy; I think the peculiarities of gravity fit in well with that idea.

14. In The Relativity Explosion Martin Gardner explains the relativity of falling objects by saying that we can consider the falling apple to be holding still while the earth and the rest of the universe moves toward it. According to this way of thinking the earth doesn't expand but only "moves" the way the fixed stars do when we are trying to visualize an accelerating rocket as being motionless. Why can't this explain the relativity of gravity?

Answer: There are many reasons why not. It may seem to work for one apple, but it breaks down when we consider a falling New York apple and a falling Peking apple simultaneously. How could the earth be moving toward them both at once, without expanding? At least Guy Murchie and other writers have noticed that. Also, the falling apple is different from the accelerating rocketship in that it is not resisting any gravity field that everything else is falling in: the apple feels like it is just floating, while both the Peking and New York observers feel as though the earth's surface is helping them resist a gravity field that everything else is falling (in other words they feel as though they are accelerating). And, of course, they are accelerating in opposite directions, as they could only be doing if the earth were expanding.

15. If mass is energy then why does an object with more mass have less repulsive force or expansion in its vicinity?

Answer: "Energy" is the capacity to do work, and work is basically anything that changes the direction of events. Since the natural course of events is for all points to expand equally, to cause some part of space to not do so is a kind of work. There may also be a better answer to this question, based on the way mass "uses" the space that "doesn't expand", but that explanation is beyond me at the moment.

16. How do these ideas relate to those of quantum physics?

Answer: I'm not sure, but they probably could be related in many ways. For example, when an electron disappears "here" and appears "there" (does a quantum jump) it may be moving in the 5th, and/or 6th and 7th dimensions.

17. Scientists observing the galactic redshift say that the universe is expanding. They don't say this is gravity and they don't say that matter is expanding. What are they saying compared with what you are saying and is there any contradiction?

Answer: The "expansion of the universe" is a still somewhat hypothetical phenomena, which involves having every galaxy move away from every other galaxy, at a rate proportional to their distance from each other. Scientists believe this is happening because the light from distant galaxies is redshifted to a degree proportional to their distance, and because one thing which is known to redshift light is motion of the source of that light away from the observer. The peculiar thing about this motion, if it exists, is that its center is everywhere; that is, anybody in any other galaxy sees the velocity of other galaxies as exactly proportional to the distance of that galaxy from them. Let us consider two observers watching a galaxy that is midway between them Each sees that galaxy as moving away from herself and thus towards the other; the only reason the middle galaxy doesn't seem to be getting closer to the far observer is that the far observer appears to be moving away even faster than the middle one. Overall, this motion is quite strange, as everyone is moving every which way at every possible rate depending on where you observe them from, all at once. To make the idea stranger still, there is the fact that galaxies far enough from us must be moving away from us at faster than the speed of light, and so their light can never reach us. Of course, as galaxies move further away they must begin moving away even faster, or accelerate, since the rate of recession must remain proportional to distance (from the observer). Eventually, if nothing counteracts this, every galaxy should be moving away at the speed of light from every other galaxy, and so every galaxy would become a finite universe unto itself.

During all of this the galaxies themselves are imagined to never expand; it is essentially a case of space expanding relative to matter. It is thus a kind of opposite effect to gravity as we have been imagining it, which is an expansion of matter relative to the space around it. Lest the reader get lost here, let me explain a few of the convolutions involved in the relationship between general relativity and the expanding universe idea The general theory of relativity originally predicted the galactic recession, as a side effect of the gravitational equations. This prediction happened to occur before anybody knew about any galactic recession, so Einstein thought his prediction must be wrong, and he introduced a "cosmological constant" into his equations to keep the effect from happening. The cosmological constant stood for a repulsive force which acted to counteract the force of gravity and which kept the universe from expanding. Exactly how a repulsive force kept the universe from expanding is equally as difficult to understand as how an attractive force (or positive curvature) made the universe want to expand in the first place. (Remember the galactic recession is caused by something which derives from the force of gravity in Einstein's equations.) Anyway, once Einstein found that the galaxies seemed to be moving away from each other he saw no more need for any "cosmological constant" to keep this from happening.

It is interesting at this point to note that there have been a few people who have proposed a "flipped" expanding universe model: in it matter contracts slightly relative to space over time. Hoyle and Narlikar have developed a whole theory of the evolution of the universe based on such a model: see the article "The Hoyle-Narlikar Cosmology" by William Kaufmann, III, in "Mercury", May/June 1976 issue, for an introduction to their ideas. Also, Sir Arthur Eddington had this to say on the subject; "All change is relative. The universe is expanding relatively to our common material standards; our material standards are shrinking relatively to the size of the universe. The theory of the "expanding universe" might also be called the theory of the "shrinking atom"." (p.90, Space, Time, and Gravitation, or perhaps it was The Expanding Universe, by Eddington.)

In our flipped gravitational theory, if we were ever to introduce a cosmological constant, we would perhaps introduce it as a force of attraction which would somehow keep the universe from contracting in the sense it is discussed above. But of course, there apparently is no need for any cosmological constant, since the universe is doing whatever it was the cosmological constant was introduced to keep it from doing, which should be somewhat uncertain in the reader's mind by now. Let us try to at least get a general feeling for what is going on here. Matter, according to the theory presented in this essay, can be viewed as expanding, but somehow the expansion of space in its vicinity becomes slow relative to the expansion of that matter. That much is what is observed as the force of gravity.

However, areas of space far away from matter (between galaxies) appear to have an extra-fast expansion, faster than matter. This is what is observed as the galactic recession. Or we could say that matter is expanding slightly less than the expansion of space away from matter, which is the same thing expressed differently. In either case it must somehow be an effect of the slowed expansion near matter, since Einstein already showed that the galactic recession is an effect of gravitational fields. (But perhaps something different is going on than any of us have imagined, and no one has been able to see it yet. That would not be too surprising, given the perspectives that people have missed seeing in the past, some of which I have discussed in this essay).

While I am sure I haven't made everything perfectly clear, I have at least given the reader a few hints as to how to relate the two types of expansion. I also hope I have shown the reader that the galactic recession appears confusing and somewhat paradoxical when viewed from any perspective and not just from that of the present theory. All of our present "scientific cosmologies" are full of paradoxes, which are routinely glossed over by those who wish to make it appear that they know what they are talking about. (A blatant example: theorists say there was "no time" before the big bang. In that case, how did the big bang find time to happen in? One gets the impression that they would simply prefer to not face the uncertainty of what preceded the big bang, because there is no way they can see to investigate it. Hoyle is an exception here.)

THE END

If you believe, as I do, that these ideas are important enough that anyone in physics and/or philosophy should hear of them, then it is up to you to help spread them around, by mentioning them to others. Some very interesting conversations can result. If you need more copies of this essay, just copy it yourself on any old copy machine. If you feel you could improve on the ideas in here, please let me know. If you have spinoff ideas, please let me know about them also.

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At some point I would like to develop these ideas into a book. With some assurance of a publisher, I could spend the time it would take to more carefully define all the terms, add more drawings, and especially to add more material which couldn't be presented here for lack of space. If you can refer me to any such publisher, please let me know.

Appendix

This essay has been about the meaning of relativity theory, specifically as it applies to gravity. This appendix is more generally about the meaning and implication of relativity as it applies to other matters, for example the speed of light.

Many writers on the subject make it appear that no thing can go as fast as the speed of light because the mass of an object increases as it accelerates and so it becomes increasingly difficult to accelerate, say, a spaceship, as that ship approaches the speed of light. This conjures up images of some space-captain valiantly adding more and more fuel to his rockets, while his ship becomes more and more like a piece of lead and just won't go any faster. This image is completely false and misleading. I first began to suspect this when it occured to me that if the mass of the spaceship were to increase as it accelerated then so should the mass of the fuel in its fuel tanks: and when this mass was liberated as energy it should be just as much more energetic as the ship was more massive, allowing the ship to continue to accelerate up to and beyond the speed of light. At first this line of reasoning made it seem to me that maybe spaceships <u>could</u> potentially exceed the speed of light, but I quickly found that they could only do so in a special sense.

If I want to take a 110 mile trip, and I am limited to a speed of 55 miles per hour, then I must spend 2 hours on the trip as recorded by my watch or by anyone else's. But if I want to go to a destination 10 light years away, and if I have a spaceship that can go extremely close to, but not at, the speed of light, then I can get to my destination in 2 minutes or less as <u>recorded on my watch</u>. Conventionally it is said that the clocks on the spaceship have slowed down, and so I only think I have travelled 10 light years in 2 minutes, but that is not a necessary viewpoint from a truly relativistic perspective. Why should one clock be preferred any more than one frame of reference be preferred? (Or at least, if there are preferred clocks then there are preferred frames of reference and relativity theory is wrong. For the faster clock would always necessarily be the non-moving one). Relative to my own clock, which is as good as any, I have travelled a ten-light-year distance in much less than ten years, without any interference from any cosmic speed cops.

At the same time, I can certainly not arrive at my destination faster than the burst of light announcing my takeoff: I will arrive two minutes after that burst of light. And if I take another two minutes to go back to earth to see how I am being experienced there (assuming I started from earth), I will arrive two minutes after the light that allows them to see me turn back towards earth - but that will be 20 years and 4 minutes after I originally took off from earth, as recorded on earth! I could explain this to myselt by saying that the people on earth suffer from an extreme speeding up of their clocks whenever I go on a trip, an unpleasant by-product of my voyages, but one which they will just have to put up with.

It can easily be seen that the speed of light, the celebrated "absolute" of relativity theory, is not absolute at all. As a spaceman with a perfectly good clock, I should be able to measure the speed of light as well as anyone. Let's say I know that it is ten light years back to earth. So, if I take 2 minutes to get to earth, then I might naturally reason that the light announcing my takeoff for earth should arrive ten years, minus two minutes, <u>after</u> I do. But it arrives 2 minutes before I do, or exactly when I calculate I took off, so I must conclude that the speed of light is instantaneous! Ordinarily it is <u>assumed</u> that the speed of light is constant, and so my watch <u>must</u> have slowed down: and while it is true that it is sometimes easier to make sense of everything this way it is nevertheless important to distinguish arbitrary assumptions from scientific findings.

The speed of light is strange from another perspective. If light traveled at any ordinary finite speed, then it would be possible to make that speed seem larger or smaller to oneself by travelling relative to it. But this is not possible: even the fastest traveler still experiences light as traveling away from him or herself at 180,000 miles per second. Light travels at what is in some senses a finite speed, but it is an infinite speed in the sense that one can never approach it to any degree. (Any finite number is no closer to infinity than any other: 5 million is no closer to infinity than 1). If a space traveler could travel at the speed of light, she or he would experience no time elapsing on that journey; this suggests that light must in some sense already be where it is going because relative to itself it takes no time to arrive.

The point I wish to stick with the reader is that the speed of light does not have to do with a mass increase (it is not a mass increase that prevents things from reaching or exceeding the speed of light) but rather it is the warped nature of time that makes this speed limit appear to be true from certain perspectives. While I am sure I haven't made everything perfectly clear, at least I've made it more clear where the clouds are. Now for some more general clouds:

Altogether, it is frustrating to read most books and articles on relativity because of the unwillingness ot sincerely face the implications of that theory. Ever since the theory appeared lay people have connected the idea that all motion is relative with their intuitive idea that every thing is relative, that one thing only makes sense when you relate it to something else, and even the idea that every thing is only relative, that in an absolute sense nothing exists. Scientific writers usually like to make it appear that these lay intuitions are invalid, that relativity theory is scientific as opposed to philosophical and that no one should ever try to derive philosophical conclusions from it. But a little simple reasoning shows differently. Einstein proved that everything, or all mass, is a form of energy, and energy in turn is classically defined as the capacity to do work, or it can be something which is doing work in the present moment. But work is nothing but motion of one kind or another - if work is working, it produces change, and nothing can change if it doesn't move - so energy is essentilly motion or potential motion. But all motion is relative: so therefore all energy and therefore all matter and therefore all objects are relative. They do not have any existence in and of themselves. My conclusion states no more than my premises, which are Einstein's theories and the usual definition of energy, yet that conclusion is not likely to be made by any writer on relativity. It is but one of many conclusions which can be, but usually aren't, drawn from relativity.

If things are relative motions, or at least potential motions (actually all energy is moving right now, as you can see if you've understood the fourth dimensional bit) then nothing about a thing is true in an absolute sense: a quality of a thing only appears when it relates in a particular way with something else. This looks even stranger if we consider that in relativity theory it is always possible to say that any particular thing, no matter how much it appears to be moving from other frames of reference, can [illegible] be considered to be motionless while other things move in such a way as to make the non-moving thing appear to be moving. So a house is not even definitely a motion: it might just be nothing at all which only appears to be a house because of the way other things move. But those other things are just relative motions themselves, also only defined by other such relative motions, none of which substantially exist on their own. So asserting the existence of any thing is a circular argument, reality is a circular argument.