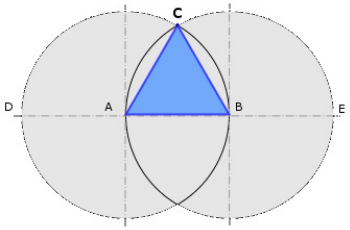
Chapter 6. The ABC's of Awareness: An Introduction to Wave Guides

Geometry

Euclid is generally considered the father of geometry. Euclid lived in Alexandria during the time of Pharaoh Ptolemy I, and although he had a Greek name and wrote in Greek, the learned language of the day, he was probably translating and systematizing principles of geometry that he learned from the Egyptians and from researches in the great library of Alexandria. His concept of geometry is also influenced by the ideas of Plato (abstract forms underlying physical reality) and there is also evidence he drew on materials from several of Plato's students for his **Elements**. His approach to geometry was to work from definitions and axioms to develop propositions and constructions. In his constructions Euclid permitted only the use of a pencil or other drawing tool, an unmarked straight edge for drawing lines and collapsing compasses for drawing circles and arcs. Collapsing compasses could not be used for marking off distances of a specified size. These tools function as wave guides to generate his figures of geometry, usually on a plane surface.

After establishing his definitions, postulates, and axioms, Euclid begins his Elements with Proposition I.1: "On a given straight line to construct an equilateral triangle." (from Heath's translation)



Euclid sets out to construct his triangle on line AB. With center at A and distance AB he describes a circle BCD, and with center B and distance BA he describes circle ACE. These steps are from Postulate 3 that a circle can be drawn from any center and distance. From point C where the circles cut each other he draws lines CA and CB to points A and B by his Postulate 1 (a line can be drawn connecting any two points.) Because point A is on circle BCD, AC equals AB. (Definition 15, a circle). Point B is the center of circle ACE, so BC equals BA (also by definition of a circle). CA = AB, so both CA and CB = AB and CA = CB. (Axiom 1, on equality). So the three sides of the triangle are equal and it is equilateral. (Based on Eves and Newsom, pp. 43-44.)

Oddly enough, Euclid makes a major error in his very first proposition that renders his proof invalid! When he says the circles cut each other at point C, he has made an assumption that is not guaranteed by any of his definitions, postulates, and axioms. In Postulate 5 he states that if two coplanar lines are intersected by a line at less than two right angles, the two lines extended indefinitely will meet on the side that is less than two right angles. However, he has no such postulate concerning circles intersecting with circles or straight lines. Euclid's transparent belief that the circles intersected seems so obvious that it is just how things are. The circles must be coplanar.

Nevertheless, it is almost certain that Euclid put Proposition I.1 as a construction at the

beginning of his book mainly because it is a logo of sacred geometry. In the construction we start with a line and then construct in perfection the two simplest figures, circle and triangle. We also see the vesica pisces and a silhouette of the pyramid of Egypt, suggesting homage to the land in which he learned the secrets of geometry and witnessed its practical application on a grand scale.

Euclid also wrote a work entitled **Optics** that is the earliest surviving Greek work on perspective. "In its definitions Euclid follows the Platonic tradition that vision is caused by **discrete rays which emanate from the eye.** One important definition is the fourth: "Things seen under a greater angle appear greater, and those under a lesser angle less, while those under equal angles appear equal." In the 36 propositions that follow, Euclid relates the apparent size of an object to its distance from the eye and investigates the apparent shapes of cylinders and cones when viewed from different angles. Proposition 45 is interesting, proving that for any two unequal magnitudes, there is a point from which the two appear equal." (**Wikipedia**, "Euclid") The emission theory of vision is largely discredited these days and replaced by the "intromission" theory. However, when we examine the nature of light from the viewpoint of classical optics the two directions are equivalent. From the viewpoint of modern physics we will discover that light has peculiar properties that combine "retarded" and "advanced" photon beams. The retarded aspect travels at light speed from object to observer. The advanced version travels faster than light backwards in time from the observer to the object of perception via a beam of attention. Thus both emission and intromission are correct. From the viewpoint of light, no motion occurs.

Exercise: Palmer comments on perspective: "The easiest way to change something is to change your viewpoint. This does not always result in a change to the world, but it will place you in the optimum position should you wish to make a change in the world." (**ReSurfacing**, p. 93) Do exercise #18, "Viewpoints" and practice observing things that are large, small, near, and far.

The great crisis of ancient mathematics was when the Pythagoreans discovered that the diagonal of a square was an incommensurate value $\sqrt{2}$. Pythagorean mathematics was based on commensurate ratios, so the discovery of irrational, incommensurate quantities threw them into a logical crisis. Eudoxus, a follower of Plato who spent 16 months in Heliopolis (Cairo of modern times) studying Egyptian mathematics and astronomy, found a solution to this crisis that Euclid included in his Elements.

"In Definition 5 of Euclid's Book V we read:

> *Magnitudes are said to be in the same ratio, the first to the second and the third to the fourth when, if any equimultiples whatever be taken of the first and third, and any equimultiples whatever of the second and fourth, the former equimultiples alike exceed, are alike equal to, or alike fall short of, the latter equimultiples respectively taken in corresponding order.*

"If we take four quantities *a*, *b*, *c*, and *d*, then the first and second have a ratio *a*/*b*;

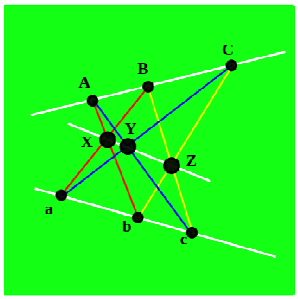
similarly the third and fourth have a ratio c/d. Now to say that $a/b = c/d$ we do the following: For any two arbitrary integers, m and n, form the equimultiples $m \cdot a$ and $m \cdot c$ of the first and third; likewise form the equimultiples $n \cdot b$ and $n \cdot d$ of the second and fourth. If it happens that $m \cdot a > n \cdot b$, then we must also have $m \cdot c > n \cdot d$. If it happens that $m \cdot a = n \cdot b$, then we must also have $m \cdot c = n \cdot d$. Finally, if it happens that $m \cdot a < n \cdot b$, then we must also have $m \cdot c < n \cdot d$. Notice that the definition depends on comparing the similar quantities $m \cdot a$ and $n \cdot b$, and the similar quantities $m \cdot c$ and $n \cdot d$, and does not depend on the existence of a common unit of measuring these quantities. The complexity of the definition reflects the deep conceptual and methodological innovation involved. . . .

"The Eudoxian definition of proportionality uses the quantifier, *for every* ... to harness the infinite and the infinitesimal, just as do the modern epsilon-delta definitions of limit and continuity." (**Wikipedia**, "Eudoxus")

Projective Geometry

In Observer Physics we draw attention to a mathematical tool called Projective Geometry that has been somewhat neglected in the primarily Cartesian dominated "checkerboard" and "measurement" version of science that has been popular for the last few centuries. Projective Geometry (PG) was developed by Desargues, Poncelet, Pascal, Brianchon, and others in the 18th and 19th centuries. Many people assume that PG is just a tool the artist uses to design the perspective effects in his painting. It goes much deeper than that.

Pappus of Alexandria (4th century A.D.) produced an important theorem that was a precursor to projective geometry.



"Given one set of collinear points A, B, C, and another set of collinear points a, b, c, then the intersection points X, Y, Z of line pairs Ab and aB, Ac and aC, Bc and bC are collinear, lying on the *Pappus line*." (**Wikipedia**, "Pappus's Hexagon Theorem")

The PG way of doing geometry brings out the remarkable principle of "Duality" in the design of our universe. Every theorem of PG can be flipped in terms of points and lines or lines and planes, depending on what and how we are observing. The more recent discovery that the physical world is defined in terms of conjugate pairs suggests that this way of doing mathematics may give us some very useful models for studying our world.

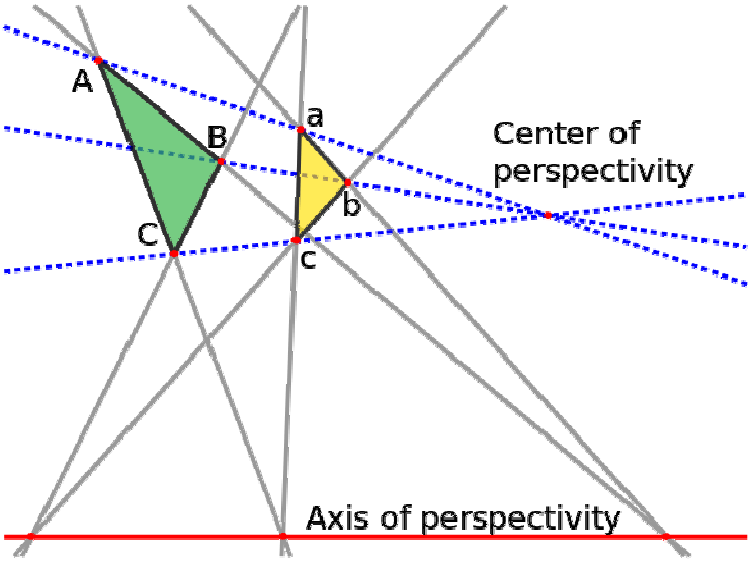
Here are some examples showing the duality principle. I culled these from Olive Whicher's beautifully illustrated book, **Projective Geometry**, pp. 77, 78.

"Any two planes have one and only one common line. This line contains all the points which the two planes have in common. (Any two points have one and only one common line [and any two lines have one and only one common point]. This line contains all the planes which the two points have in common.)

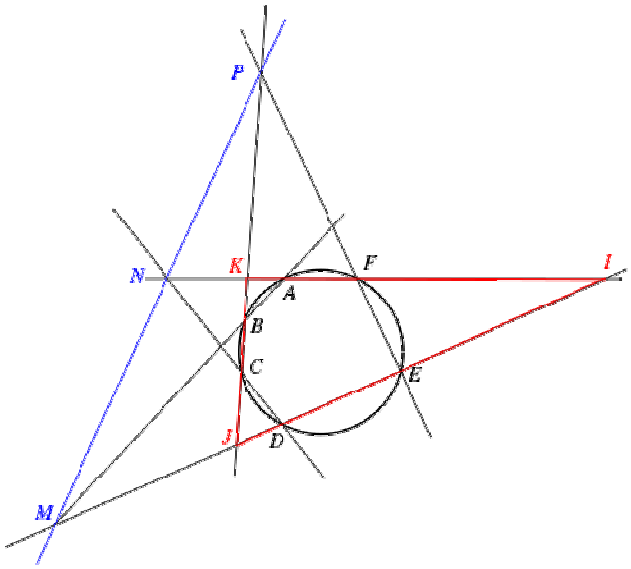
"Any three planes have a common point. If they have more than one point in common then all three lie in a line. (Any three points have a common plane. If they have more than one plane in common, then all three lie in a line.)

"A triangle is any three lines in a plane, but not all in a point; or any three points in a plane, but not all in a line."

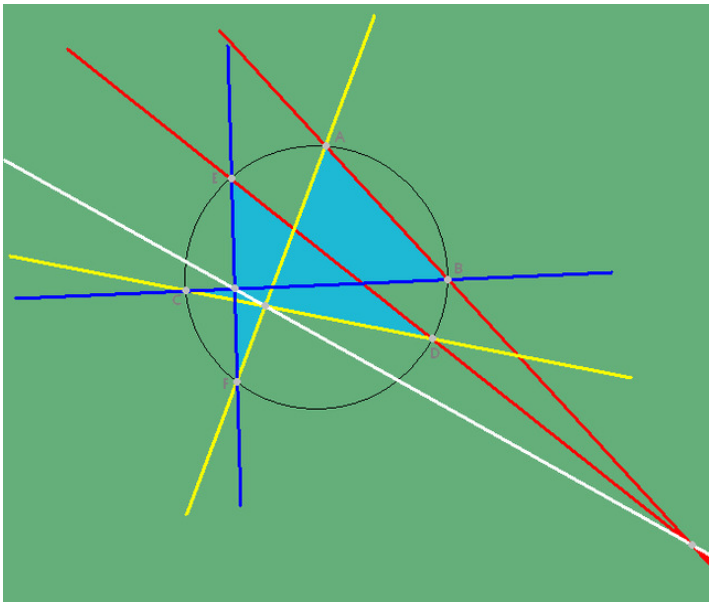
The remarkable two-triangle theorem of Desargues says that if the three lines (Aa, Bb, Cc) passing through the two corresponding points of each of two triangles converge in a point (center of perspectivity), then the three points where the pairs of lines of the two triangles (AC, ac; BC, bc; AB, ab) converge will lie on a line (axis of perspectivity). The triangles may lie anywhere on a plane or in free space.



The amazing conic section theorem discovered by Desargues' student, Blaise Pascal (at age 16!), says that you may pick any six points on any conic section (circle, ellipse, parabola, or hyperbola) and if a hexagon of any kind is drawn connecting those six points, the points where the extended opposite sides of the hexagon intersect will be collinear. The line is called the Pascal Line. Pascal called this property of conic sections the Mystical Hexagram. For example, for hexagon ABCDEF below, AF and CD converge at N; BC and FE converge at P; AB and DE converge at M on line MNP. There are altogether 60 ways to organize 6 points on a conic section into a hexagon with 60 different Pascal lines. Some lines are at infinity.

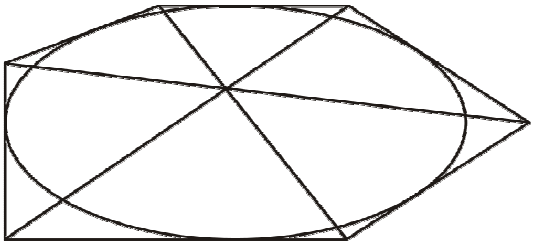


"These 60 lines can be associated with 60 points in such a way that each point is on three lines and each line contains three points. The 60 points formed in this way are now known as the **Kirkman points**. The Pascal lines also pass, three at a time, through 20 **Steiner points**. There are 20 **Cayley lines** which consist of a Steiner point and three Kirkman points. The Steiner points also lie, four at a time, on 15 **Plücker lines**. Furthermore, the 20 Cayley lines pass four at a time through 15 points known as the **Salmon points**."



A "jazzy" hexagon inscribed in a circle.
Red, yellow, and blue indicate opposite sides and white gives the Pascal Line
(See **Wikipedia**, "Projective Geometry" for quotes and images regarding hexagons.)

Here is the theorem of Brianchon that pairs up with Pascal's theorem.



"Let *ABCDEF* be a hexagon formed by six tangent lines of a conic section. Then lines *AD, BE, CF* intersect at a single point. The polar reciprocal and projective dual of this theorem give Pascal's theorem." (**Wikipedia**, "Brianchon Theorem")

Usually physics is very concerned with measurement. The Cartesian approach with its analytic geometry fits this particular interest nicely. PG is not involved with measurement, but is an exploration of how forms spontaneously arise from the interaction of nonlocal phenomena. The brilliant Jesuit scientist Roger Boscovich worked on a theory of conics, dealing with transformations through the infinite, an approach closely related to PG.

The Euclidean approach to a hexagon is to mark the radius of a circle six times around the circle's circumference and then join the points. We then get an equilateral hexagon oriented around a central point. In PG a general hexagon is formed from any six points or six lines in a Euclidean plane.

Exercise: Take a pencil and a ruler and a blank sheet of paper (i.e., a "plane"). Anywhere on the paper draw a straight line. Then choose any three points on the line and mark them. Draw a line through each of the three points, each at an arbitrary angle. These lines will intersect at three points and form a triangle. It helps to keep the points of intersection on the paper, but it is NOT necessary, so long as you keep track of your lines. Now keep connecting your three collinear points to vertex points of the triangle and to other intersections that appear until you have three lines projecting from each of the collinear points. A hexagon will grow from the original projected triangle. When you draw the last line, notice how the three points it passes through are collinear, as if by magic. This construction is not equilateral and spatially symmetrical like the hexagon inscribed in a circle by marking radii. It is projective. The symmetry is more abstract.

Exercise: Practice drawing various kinds of hexagons from six points along any conic section curve. Construct the Pascal Lines for them.

Another attractive feature of PG is that it actively incorporates infinity into its viewpoint right from the start. Playing with PG is a wonderful exercise for developing a sense of non-local awareness and shifting out of our habit of thinking and perceiving locally. A line has one point at infinity, and a plane has one line at infinity.

For example,

"*Any* two lines lie in a plane, *if* they have a common point, and *any* two lines have a

common point, *if* they lie in a plane. The statement is true without exception only if parallel lines are included. Any two planes have a line in common; two (or more) parallel planes have an *infinitely distant line* in common." (Whicher, p. 76.)

Exercise: Practice until you can visualize the **single** infinitely distant line that is shared by two parallel planes. Then practice until you can visualize the **single** point at infinity that is shared by two parallel coplanar lines.

I highly recommend Whicher's book, because she not only provides an excellent introduction to projective geometry, but she also has a wonderful sense of art and the value of expanded awareness that this geometry brings. The illustrations are excellent and, by themselves, are worth the price of the book.

Projective Geometry is about our ability to generate focal points in undefined space, direct lines of attention, and observe with expanded awareness how points of focus, lines of attention, and manifolds of awareness interact and generate forms. Attention forming points, lines, planes, and the illusion of solid images in perspective is achieved through the operation of the will as a guide to defining undefined awareness. The images of PG are wonderful objects for contemplation.

Newton's Strange Bucket

The classical laws of motion that Newton gave us are very elegant, but certain aspects leave nagging questions. For example, Newton's second law, $F = ma$, depends on a reference frame. Otherwise the m's and a's are meaningless, not to speak of the F's. But Newton could never provide such a frame, and ended up depending on $F = ma$ for any frames, which is a rather circular approach. Lately there seems to be some support swinging back toward Mach's ideas about cosmic background mass. Mach suggested that all the galaxies out in the cosmos might be generating inertial forces in moving objects somewhat like a charge moving in a magnetic field produces current. Mach's idea of cosmic backgrounding by galaxies is interesting, but it needs refinement and some way of testing.

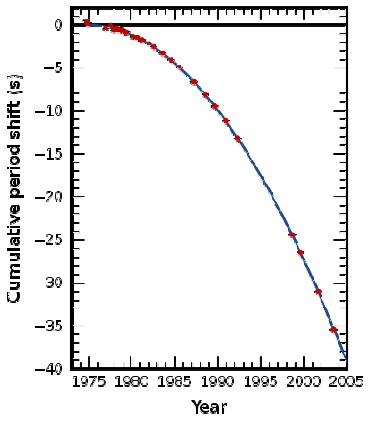
Newton's water bucket experiment is a simple exercise you can do if you want to boggle your mind on the inertial frame question for a while.

Experiment: Find a pail with a handle and a length of rope. Attach one end of the rope to a tree branch in your yard or some other suitable place, and attach the pail's handle to the other end of the rope. Fill the pail about half full of water. Then wind the pail on the rope until the rope is tightly wound, and the bucket is suspended in midair. Hold the bucket still until you see that the water is calm. Notice how the water's surface is flat (except for the tiny curve due to surface tension at the edge). Now let go of the pail. It will begin to spin as the rope unwinds. Watch the water. As the pail starts to spin, the water will remain still. Then it will gradually start to spin along with the pail due to friction between the water and the pail. Eventually the pail and the water will spin at the same speed. You will notice that the water is now climbing the sides of the pail and its surface is noticeably concave.

If motion is really relative, then why is the water's surface flat in one context where pail and water are relatively at rest, but concave in the other mutually resting but spinning context? If the pail were to be totally isolated from any reference frame, how could the water tell whether it was resting or rotating so that it would know when it was supposed to exhibit inertial forces and distort its shape?

Explaining this phenomenon with Mach's principle may turn out to be a giant red herring. The galaxies are extremely distant and their gravitational effects drop off with distance. We have no evidence on a small scale of gravity waves or field interference at a distance, nor can we as yet even detect gravity waves on **any** scale, though the existence of the gravitational fields seems obvious due to the at-a-distance interactive behavior of large celestial objects.

Hulse and Taylor have observed "*recycled* pulsars, neutron stars that have been spun-up to fast spin rates by the transfer of mass onto their surfaces from a companion star. The orbit of such a binary system is slowly shrinking as it loses energy because of emission of gravitational radiation, causing its orbital period to speed up slightly. The rate of shrinkage can be precisely predicted from Einstein's General Theory of Relativity, and over a thirty-year period Taylor and his colleagues have made measurements that match this prediction to much better than one percent accuracy. This was the first confirmation of the existence of gravitational radiation. There are now scores of binary pulsars known, and independent measurements have confirmed Taylor's results." (Quoted from **Wikipedia**, "Joseph Hooton Taylor")



(Data from **Wikipedia**, "PSR B1913+16")

More recently on September 14, 2015 at 9:51 UTC (coincidentally on the 100th anniversary of Einstein's presentation of his general relativity theory) the two Laser Interferometer Gravitational-wave Observatory (LIGO) detectors located in Livingston, LA and Hanford WA both detected a signal that they interpret as a gravity wave impulse from an event of two black holes combining into one. The scientists estimate that the two black holes were 29 and 36 solar masses. The event occurred about 1.3 billion light years away and hence that many years ago. During the event about three solar masses were converted into gravitational waves in a fraction of a second. This observation confirmed the results of Hulse and Taylor mentioned above.

Astronomical research may confirm the existence of gravity waves, but a bucket of water on earth hardly compares to a large and superfast spinning neutron star 21,000 light years away. Although Earth's gravity clearly plays a role in the bucket experiment, it hardly can be responsible for the inertial mass of the water causing the water to climb the sides of the bucket.

A simpler explanation of inertia involves the Observer, who in this case must also be a participant in the experiment. No matter where he places himself, he KNOWS that he has altered the momenta of the system's components by spinning the bucket at some rotational speed in HIS VIEWPOINT FRAME. Even if he's **in** the bucket, he knows he started it spinning in some way and can feel the inertial tidal forces as the water body starts to distort its shape. He can calculate the changes that occur in Newton's bucket experiment from the observer's frame as Prime Mover.

The Prime Mover's frame must be **nonmoving relative to the moving bucket system** or the Prime Mover could not remember the prior non-moving condition of the bucket. Forget the galaxies and the rest of the universe. You need only the Prime Mover Observer and his "Urframe" -- the prior non-moving state in his consciousness in which the initial conditions held for the bucket and the water. The rest can be empty space.

The water is a set of many microscopic loose particles in a liquid state, and the bucket functions as a SINGLE macroscopic particle because of its much tighter molecular bonds. The participating observer as Prime Mover has set the bucket spinning. Slight friction between the bucket's surface and the water particles gradually imparts momentum to water particles at the outer rim so they move tangential to the bucket's spin direction as the stiff bucket moves circularly relative to the still water. Each water particle has a different momentum, and thus the relative positions of all the various particles will change vis-a-vis the original resting condition of the system and vis-a-vis each other. The bucket acts as a **wave guide**, containing the water and curving the shape of the water's liquid surface and the water pushing against the bucket's side. Using Newton's equations of motion we can calculate the concave shape of the water's surface from the interaction of the moving water particles with the bucket wave guide. Gravity serves to keep the water in the bucket and thus also plays a role. Newton's bucket is a rotating cylindrical wave guide. The Observer is the Prime Mover who sets the bucket in motion thereby imparting kinetic energy to the bucket, and the bucket then imparts some of that motion to the water molecules.

Wave Guides in General

What are the dynamics of wave guides? Let us begin to introduce the dynamics of wave guides. Later we will develop this into a theory of relativistic quantum inertial gravity and rotational kinematics. Only then will we see the complete picture of Newton's bucket. We will move a step at a time, introducing the fundamental principles.

First a word about what wave guides are. Wave guides are expressions of a powerful and general foundational technology. This technology involves establishing boundaries

that guide the paths of radiation, fluids, or any form of matter or energy, including information and consciousness, -- anything that can move with wavelike motion. Wave guides are commonly used in microwave technology. Optical fibers are wave guides. The plumbing in your house is another application. Your will is a wave guide for your attention. Dimensions are wave guides for measurements. Notice the markings on your ruler. A geometer's straight edge and compasses are wave guides for his pencil.

Wave guides provide boundaries that direct wavelike flows of any kind. A key aspect of wave guide technology is the relationship between phase and group waves. In the case of electromagnetic radiation group waves are always sub-luminal and local, whereas phase waves may be superluminal, holistic, and non-local. When you see wagon wheels in Western movies turn backwards, those are phase waves caused by the interaction of the turning wheel spokes and the strobe effect of the flickering video medium. The axis of rotation of a spinning top creates a phase wave. The sweep of an oscilloscope or a lighthouse beam is a phase wave. The sliding of scissor blades past each other is a phase wave. The phase wave itself is not a physical thing, but is the result of the observer's perspective of perceiving how two things interact. A wave has a cycle and different portions of the wave cycle represent phases. The phase velocity of an electromagnetic wave moving through space is its wavelength times its frequency.

If scissors blades are 6 inches long and you snip with them once a second, the phase velocity from the fulcrum to the blade tips as the blades slide by each other is 6 inches per second (1 second per snip and 1 second to reopen the blades) and represents the speed at which the slicing of the blades travels from the pivot point to the blade tip. However, the finger grips may only move about 2 inches per second. This is the group velocity of the physical blade. Even the tips of the blades may only move 4 inches per second, which is less than the phase velocity. The phase wave of a blade that chops horizontally is nearly infinite. The axis of rotation for a top is a phase wave generated by the opposing movements of the opposite sides of the top. At high spin rates the central axis almost does not move and the outer edge of the top moves very fast.

The relation between electromagnetic local, physical (group) waves and non-local, nonphysical phase waves is.

* $(v_g)\ (v_p) = c^2$.

We derive it as follows, where E is energy, h is Planck's constant, f is frequency, and the particle, for example, may be an electron, but may include atoms and molecules.

* $E = hf$ (Einstein's postulated quantization of electromagnetic (EM) energy)
* $\lambda = h/p$ (De Broglie's wavelength λ and momentum p of a particle)
* $f = E/h$ (De Broglie's frequency f and total energy E of a particle)
* $v_p = \lambda f = E/p$ (The phase velocity of EM waves in space, wavelength × frequency)
* $v_g = pc^2/E$ (The special relativity group velocity)
* $v_g\, v_p = c^2$ (The velocity equation -- see **Wikipedia**, "Matter Wave")

Here are more details of the calculation from the "Matter Wave" article.
"Using the relativistic momentum formula from special relativity
$p = \gamma m_0 v$
allows the equations to be written as
$\lambda = \frac{h}{\gamma m_0 v} = \frac{h}{m_0 v}\sqrt{1 - \frac{v^2}{c^2}}$
$f = \frac{\gamma m_0 c^2}{h} = \frac{m_0 c^2}{h\sqrt{1 - \frac{v^2}{c^2}}}$
where m_0 is the particle's rest mass, v is the particle's velocity, γ is the Lorentz factor, and c is the speed of light in a vacuum. . . . Group velocity (equal to the particle's speed) should not be confused with phase velocity (equal to the product of the particle's frequency and its wavelength). In the case of a non-dispersive medium, they happen to be equal, but otherwise they are not.

Albert Einstein first explained the wave–particle duality of light in 1905. Louis de Broglie hypothesized that any particle should also exhibit such a duality. The velocity of a particle, he concluded then . . . , should always equal the group velocity of the corresponding wave. De Broglie deduced that if the duality equations already known for light were the same for any particle, then his hypothesis would hold. This means that

$$v_g = \frac{\partial \omega}{\partial k} = \frac{\partial (E/\hbar)}{\partial (p/\hbar)} = \frac{\partial E}{\partial p}$$

$$\begin{aligned} v_g &= \frac{\partial E}{\partial p} = \frac{\partial}{\partial p}\left(\frac{1}{2}\frac{p^2}{m}\right) \\ &= \frac{p}{m} \\ &= v \end{aligned}$$

where m is the mass of the particle and v its velocity.
Also in special relativity we find that

$$\begin{aligned} v_g &= \frac{\partial E}{\partial p} = \frac{\partial}{\partial p}\left(\sqrt{p^2c^2 + m^2c^4}\right) \\ &= \frac{pc^2}{\sqrt{p^2c^2 + m^2c^4}} \\ &= \frac{pc^2}{E} \end{aligned}$$

where m is the rest mass of the particle and c is the speed of light in a vacuum. But (see below), using that the phase velocity is
$v_p = E/p = c^2/v$.
Therefore,

$$v_g = \frac{pc^2}{E}$$
$$= \frac{c^2}{v_p}$$
$$= v$$

where *v* is the velocity of the particle regardless of wave behavior.

Group velocity (equal to an electron's speed) should not be confused with phase velocity (equal to the product of the electron's frequency multiplied by its wavelength). Both in relativistic and non-relativistic quantum physics, we can identify the group velocity of a particle's wave function with the particle velocity. Quantum mechanics has very accurately demonstrated this hypothesis, and the relation has been shown explicitly for particles as large as molecules.

Phase velocity
In quantum mechanics, particles also behave as waves with complex phases. By the de Broglie hypothesis, we see that

$$v_{\mathrm{p}} = \frac{\omega}{k} = \frac{E/\hbar}{p/\hbar} = \frac{E}{p}.$$

Using relativistic relations for energy and momentum, we have

$$v_{\mathrm{p}} = \frac{E}{p} = \frac{\gamma mc^2}{\gamma mv} = \frac{c^2}{v} = \frac{c}{\beta}$$

where *E* is the total energy of the particle (i.e. rest energy plus kinetic energy in kinematic sense), *p* the momentum, γ the Lorentz factor, *c* the speed of light, and β the speed as a fraction of *c*. The variable *v* can either be taken to be the speed of the particle or the group velocity of the corresponding matter wave. Since the particle speed $v < c$ for any particle that has mass (according to special relativity), the phase velocity of matter waves always exceeds *c*, i.e.,

$$v_{\mathrm{p}} > c,$$

and as we can see, it approaches *c* when the particle speed is in the relativistic range. The superluminal phase velocity does not violate special relativity, as it carries no information. See the article on *signal velocity* for details."

There are more details in the article, but this gives us the basic equation strictly in terms of measurable particle velocity rather than energy and mass which are abstract. If the velocity of light *c* is constant, and the group velocity is always less than *c*, then the phase velocity must always be faster than light. From the equation we know what the phase velocity is once we know the particle velocity. We are told in the last sentence quoted that the superluminal phase velocity carries no information -- only the sub-luminal group wave carries information. However, the equation shows that the same information the group velocity carries must be in the phase velocity, but in reciprocal form. The phase velocity is merely the reciprocal of the group velocity. To see this, set $c = 1$, a common practice in particle physics. If $v_g = .1$, or $1/10^{th}$ of *c*, then v_p must be 10 times *c*. Whatever value the group velocity has, the phase velocity mirrors that at a reciprocal value -- **if** we accept Einstein's assertion that the velocity of light (and all EM phenomena)

is a universal constant. Is there a contradiction, or is there something we are missing?

Of course, our attention habitually goes to the particle that is moving slower than *c*, so the superluminal phase wave component tends to go unnoticed.

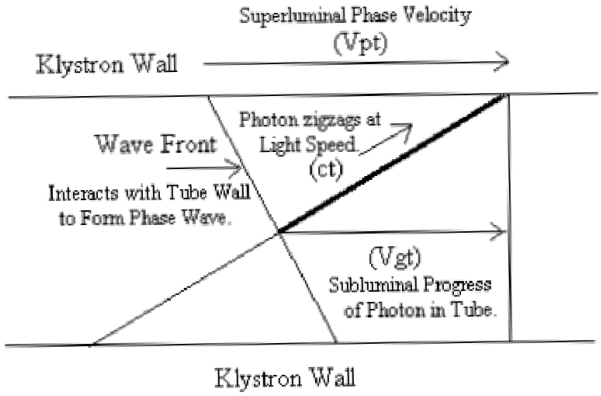
We can see the role of the velocity equation in ordinary life experience and understand the observer viewpoint transformation that we do when we switch from observing group wave information to observing phase wave information -- as well as the role of light speed. For example, you probably use a cell phone to speak to friends or to text them. When you speak or type your message into the device, you operate at the group velocity. When you transmit the message, it goes at the velocity of light. However, if you take a photo with your cell phone, the device captures the total light field image that you point the lens at onto its video memory chip in a single operation by guiding the light through a lens onto the light sensitive chip. The light travels to and through the lens at *c*, but then hits the light sensitive device in the cell phone, transferring the total image to the device in one shot, as superluminal data capture. You may then transmit the image to a friend from your phone at light speed. When your friend sees the display or prints it out, the image enters her eye, passing through the eye's lens (at light speed), but the whole image arrives onto her retina in one instantaneous shot. The optic nerves and brain then process the information at the group velocity. Optical processing of capturing a field of information in a single image via photography is superluminal.

Thus we find that hearing speech is a group wave process. Listening to a symphony and admiring art involves phase waves. Group waves are serial and phase waves are parallel. For group waves you are at the end of a communication channel and get data in individual chunks or bits. For phase waves you expand your observer perspective to take in an entire communication channel (or field, or space) and process the entire message or large chunks of information as a single block of data. You may then slow down and peruse the details one by one at leisure, processing the data in other ways. For phase wave operations **you shift your viewpoint 90 degrees and expand your viewpoint to include the entire communication system**. You must somehow transcend the data field, sender, and receiver. In a sense, there is no communication, because you already know it all. It is like clairvoyance. You have the whole picture in one shot, but you may have to sort out the details in order to use the data in "group wave" mode.

We have always been able to operate in the superluminal phase-wave mode as well as the limited group-wave mode and also light-speed mode. What we see here in the "Matter Wave" article is a strange obfuscation of scientific "interpretation". The equation is presented and speaks out in its totality loud and clear, but the commentator for some reason throws out half of the equation. Such a half-blind interpretation of a high school level equation is the "establishment" viewpoint that is standard in all the media and textbooks.

The "velocity" equation is a general principle of nature and appears in many places. Here is a sketch of a klystron wave guide used in microwave technology. It shows the relationships of the three wave types. In the drawing we convert velocities into relative

distances by multiplying each velocity by a constant unit of time (t) which we can then cancel out of the equation.

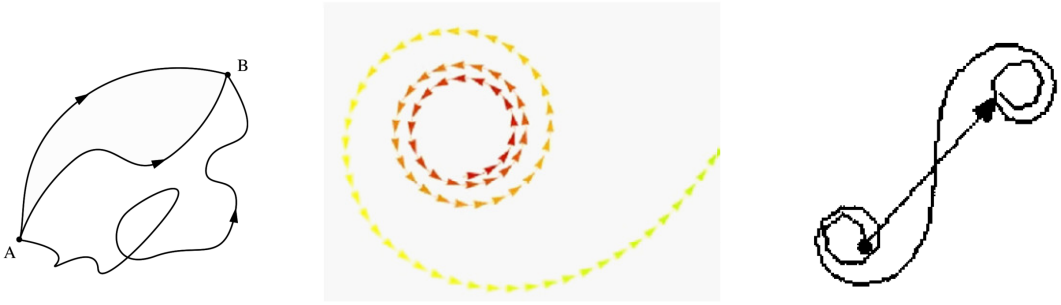


In the klystron tube, (v_g) and (v_p) are parallel motions along the direction of the tube, but (c) zigzags reflecting back and forth from wall to wall as the photon proceeds down the tube. The group velocity represents the photon's net forward progress, whereas the phase velocity represents the interaction of the photon's wave front with the tube wall as it sweeps along through the tube. The wave-front interaction is a non-local phase-wave phenomenon. The wave front is always normal to the photon trajectory. You can see from the geometry that in the tube (v_p) is always greater than (c), and (c) is always greater than (v_g) -- except at the moment when the photon bounces off the tube wall. In the infinitesimal instant of the photon's interaction with the wall, (c) drops to 0 because the photon is momentarily absorbed and then re-emitted by an electron in the tube wall. At that moment the phase wave becomes infinite and the group wave is indeterminate. An important principle for electromagnetic wave guides is that all of these velocities are interactive and can not stand alone. The phase velocity depends on the interaction of the wave front and the tube wall, the group velocity depends on the interaction of the photon with the tube wall, and the speed of light depends on the interaction between two terminal points such as electrons, an emitter and an absorber. Without terminals a photon cannot manifest.

The curious thing about the relationship between the photon and its terminals is that it always moves at speed c relative to its terminals, regardless of their positions or any other relative motions. The photon balances the differences by shifting its apparent wavelength rather than its speed. This of course makes it clear that the EM interaction is nonlocal, because **the photon does not "know" its frequency for the journey between terminals, however far apart, until it gets absorbed**. The sketch I made is only a rough rendering of the resultant of a quantum electro-dynamic (QED) process described by Feynman in which the photon radiates from its emitter source in all directions. The photon path and wave front are the resultants of wave interference in the gap between emitter and absorber as the photon follows all possible paths. The photon is really omnipresent and never moves. It is the consciousness of the observer that moves and interacts with phenomena in his environment.

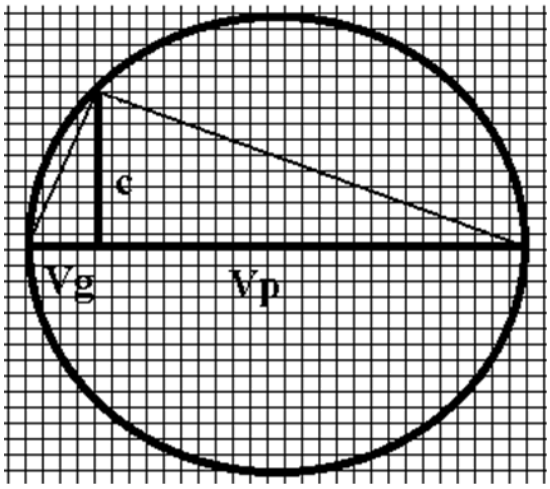
The schematic diagrams below suggest Feynman's interpretation of this notion. The

diagram on the left shows three possible paths, the middle diagram shows little arrows that go in all directions, and the third diagram shows the resultant path that appears to be a straight line. Close to the terminals the arrows are in all directions that mutually cancel. In the gap they also are omnidirectional, but cancel out to form a beam or ray of light. The interaction is actually bidirectional, going both ways between the terminals. When you observe a star 100 light years away, you see it as it was 100 years ago but in your present earth moment. The conjugate photon beam of "attention" from you as the observer goes "backwards" in time and of course faster than light. The photon from the emitter and anti-photon from the observer then as if shake hands across time and space and generate the perception event. The observer as an absorber (anti-emitter) is critical to all of physics. He collapses the light wave that shines in all directions everywhere into a finite event that occurs between a perceiver and an object of perception. (See sketch with large arrow for a light "ray" on the right below.)



(See **Wikipedia**, "Path Integral Formulation")
(Free space with charged particle terminals acts as a wave guide for photons.)

Another way of schematically representing the velocity relationship is to imagine a circle centered at the origin and divided into an upper and lower half by a horizontal diameter along the *x*-axis. Any position on the circumference of the circle can represent a set of values in the Velocity Equation.

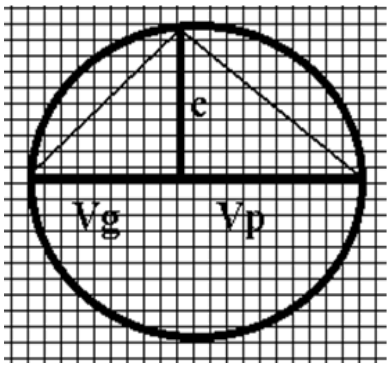


$v_g = .4\ c$ $v_p = 2.5\ c$ $c = 1$ (unit distance on grid = .1c)

In this way of graphically representing velocity relations we draw the speed of light (c) as

a vertical line between the diameter and the circumference. The vertical line generates two similar triangles with the diameter that show the Velocity Relation. The vertical distance from diameter circumference may change depending on the position of the vertical line relative to the circle's center. Thus in a sense the value of c is not constant. All three values can change, but the ratio in the velocity equation $v_g\, v_p = c^2$ stays constant. Vertical lines above the diameter may represent "retarded" light coming to the observer, and lines below the diameter may represent the "advanced" light of the observer's attention going to an object (or vice-versa). The light pole divides the diameter into two sections. If the two diameter sections are equal (i.e., radii), then the diameter represents an electromagnetic signal traveling through free space. If they are not even, the shorter portion represents a group velocity, and the longer portion represents the corresponding phase velocity. The Velocity Relation explains the tendency of the expression (c^2) to show up in dynamic equations, as for example in Einstein's Relativity Mass-Energy Equation.

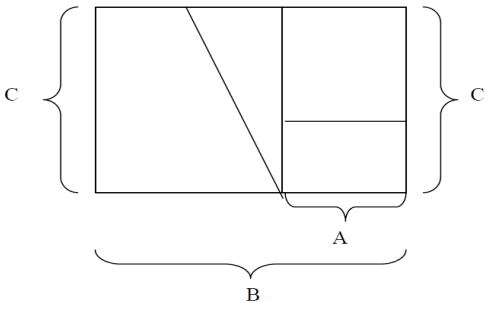
* $E = m\, c^2$.



$v_g = .9\ c \quad v_p = 1.11\ c$

Exercise: Experiment with various similar triangles. The general rule is that they must be similar and they must share two different sides in common. Right triangles are standard and their edges follow the Pythagorean relation, but other types of triangles are simply distorted versions of the standard. For example, similar triangles [A_1, B_1, C_1] and [A_2, B_2, C_2] might have $C_1 = A_2$ as their equal sides. Try making pairs of similar triangles according to this rule and play with them. See what system models you may discover.

Exercise: The Golden Ratio in a Golden Rectangle is an example of the Velocity Equation expressed spatially.



The above drawing shows an approximate Golden Rectangle. The larger rectangle is made from a square plus a smaller golden rectangle. The smaller one is made from a square and an even smaller golden rectangle. You can continue in this fashion making larger or smaller rectangles, and the pattern forms a Phi Spiral. The sides of the rectangles have the ratio: (A / C) = (C / B). In other words, (A) (B) = $(C)^2$. This is another example of the Velocity Equation represented spatially. Of course A, B, and C are also the sides of right triangles that share the side C. The smaller triangle is turned 90 degrees so that its C and the larger triangle's C form the ends of the larger Golden Rectangle.

The $(C)^2$ actually describes the square portion of the larger rectangle. So if C = 1, B = φ, and A = (φ – 1). Or, if C = φ, then B = (φ + 1), and A = 1. Thus (1 / (φ - 1)) = (φ / 1) = ((φ + 1) / φ), where φ = 1.618 . . . , an irrational number called the Golden Ratio. This ratio is also represented as φ = (.5) (1 + ($5^{.5}$)). The square root of 5 is the diagonal of a 1×2 rectangle. We get that by drawing a diagonal from the midpoint of C to an opposite corner of the larger square. If we set C = 2 units, then the diagonal is the square root of 5. By rotating the diagonal so that it runs from the midpoint of C [on top of the square] on out beyond the square, we get the total length of the Golden Rectangle as (1 + ($5^{.5}$)).

For more information about the Golden Rectangle, and its remarkable properties, look up the entry by Eric W. Weisstein, "Golden Rectangle." From *MathWorld*--A Wolfram Web Resource. http://mathworld.wolfram.com/GoldenRectangle.html.

See also the articles on "Golden Ratio" and "Golden Triangle". Other good articles can be found at various sites on the web.

The ABC's of Awareness

To get to a fundamental motivation for motion and the force(s) that manifest(s) it we need to observe in a broader context. Generally we can think of motion as change. A major interest in physics is to investigate the nature of motion and the forces that motivate it. This includes not only the motion of physical objects, but also the transmission of information.

Einstein's first general principle was that he wanted physical laws that could work from any frame of reference. This is a nice idea, but we find different laws governing different levels of creation and in different arenas of observation. Einstein and his successors have not yet come up with a theory that can completely integrate relativity with quantum mechanics. Perhaps we have not gone deep enough to find a completely unifying frame of reference for these two viewpoints.

In Observer Physics we step back from physics and begin with something we can call metaphysics. Maharishi calls it a "Science of Being". Such a science focuses first and foremost on the observer. We can not detect any motions or forces or even physics at all without at least one observer. So we have to get an observer in there, and then we can create a system or two such as relativity or quantum mechanics and see how things happen. As I draft out notes on this metaphysics behind physics, I suggest you refer to Palmer's little four-page essay, "Viewpoint and the Nature of Being" (**Living Deliberately**, Chapter 12). In his essay Palmer succinctly lays out the fundamental

principles of a Science of Being.

Let's begin with an undefined primitive that simply exists. We could label it undefined BEING. We have no idea what it is, but we will give it a name here and call it "Awareness", or (A) for short. (A) has two primitive modes, an active mode we'll call "Cancel" (C) and a passive mode we'll call "Boundary" (B). We could call (C) the Not Operator or a variety of other arbitrary names. Furthermore, (C) is the aspect of awareness that we usually call Will. (B) is what we often call a Limit or a Definition. We will also mention "foregrounding" and "backgrounding", which just mean that some preference or priority is attached to certain elements of the system. Nothing can ever really be created or destroyed. It merely changes state. The result of a (C) operation is that something is "backgrounded". By default, whatever is not backgrounded is automatically "foregrounded". We'll explain that in more detail after we go through the possible states.

Undefined Awareness and its two primary modalities coexist without sequence or priority, so there are seven illusory state possibilities that correspond nicely to the seven states of consciousness that Maharishi likes to talk about in his **Science of Creative Intelligence**. In a later chapter we will discover what these seven metaphysical (or Mental) Urstates become in the physical World. We first manifest them as Mind states by imagining VIEWPOINTS that involve sequence or priority. (I'll explain viewpoints later when we develop more definitions.) First let's look at the seven primal states. And remember, this is just a mental model.

ABC = Canceled Boundary Awareness. This is what Palmer calls "undefined awareness". It is also sometimes called Source, although Awareness by itself can also be called Source. ABC is what Maharishi refers to when he speaks of Unity and Wholeness of Awareness. "Brahman" is a traditional Sanskrit term for this. Undefined awareness is always present, at least as a "background" of any state or system. Even though we say it is "undefined," ABC actually contains all possible bounded states "within" it, but shows no preference. It is balanced in "yoga" (union). ABC is always background space to all the other six states.

A = Awareness. This is pure awareness. We may also call it Transcendental Awareness or pure Being. It is a state of no thought and no perception, and no expression of Will. Thought, perception, will, etc. are all backgrounded and just Awareness takes the foreground. (I follow Palmer's terminology and do NOT use "consciousness" to describe states in which there is no thought, feeling, or perception.) In the "pure" A state B and C are backgrounded -- become virtual -- and A is foregrounded in the ABC space.

B = Boundary. This is what we know as Definition, Limit, Gap, or Edge. It is Pure Gap, the seed form of Cosmic Consciousness and gives rise to the notion of Between as well as End. B's pure state also implies that A and C are backgrounded while B is foregrounded.

C = Cancellation. This is the Not Operator or Pure Will. It generates Dreaming state,

because it makes illusions appear to manifest in A. Ironically, when it is inactive, it coexists with A and B as ABC. When it activates, it backgrounds something, thereby bringing something else into the foreground. It sets up contrasting viewpoints. C starts by canceling (backgrounding) undefined awareness ABC. When it does so, it cancels itself in a self-destructive loop, because what you usually have left when you cancel undefined awareness is defined awareness, AB. But C can also generate any of the other six states, including itself, Will alone, all by itself. That's where the primordial feeling of loneliness comes from. Cancel can Cancel everything but Cancel itself. If it Cancels itself too, then you end up with the NULL state, which is the conjugate of, and identical to, ABC. ABC is its own conjugate. Ironically, if you background everything, you can't tell the difference between background and foreground. Cancellation only backgrounds a state into a virtual state, it never actually destroys it. That is why C has the nature of a Dream or Illusion. The pure C state just backgrounds A and B so they become "transparent" and "invisible".

AB = Awareness Bounded. Bounded awareness is called Waking State, the range of consciousness we live in during most daily activity. It generates all possible thoughts and perceptions and any imaginable creations. C is backgrounded and may become "transparent". AB's are any creations, manifestations of bounded awareness, awareness with limits, boundaries, edges, definitions.

AC = Awareness Canceled. This is the illusion of Dullness, Ignorance, Sleep, Death, inert matter, and any state where we imagine that we have canceled awareness. Ironically, by canceling A, we end up foregrounding it, and B is backgrounded. AC is therefore a state of extreme pretense.

BC = Boundary Canceled/Bounded Cancellation. This interesting state corresponds to the illusion of change, transformation, transcending. When we operate on the Gap, we can expand or contract. We can generate infinity (the cancellation of imagined boundaries) or we can resist a boundary and cancel it by putting another one on top of it. We can cancel a boundary or make a cancellation with a boundary (so it doesn't cancel everything.) This state corresponds to Maharishi's notion of the divinely beautiful range of relative consciousness. It ranges through gross and subtle, earthly and celestial, heaven and hell. The activity of the divine is to be able to transform creations magically from one state to another. Whereas AC creates the illusion of awareness having died or become lost, BC creates the illusion of transformation itself. AC is one possible outcome of BC. So is AB. BC (or CB) can transform any state into any other state. It can also transform substates. For example it can turn one AB into another. Think of Fourier analysis or QED and the use of filters and grates on wave forms. Boundaries can be modified at will. This is the magical world where Buddhas, Bodhisattvas, Avatars (and physicists) play. Of course, if they are enlightened, they know that BC is really ABC, since undefined Awareness is always present and underlies every state, even when the observer doesn't notice it, because it appears backgrounded during the dynamics of transformation.

Now that we have our seven primitive states, let's fill in some other definitions so we

have some terms with which to discuss and develop our theory of observer physics. One of the first things we will have to do is define an observer. But let's proceed in an orderly fashion.

BELIEF = anything with any boundaries (foreground or background), including any of the above seven states. Remember that B is always present, either in the foreground or background.

CREATION = the BC process of setting a boundary, of defining a belief. Its outcome usually is an AB arising either from ABC or from another AB. Section II of the **Avatar Materials** provides the tools for managing the creation process at any level or scale.

EXPERIENCE = the CB process of dissolving a boundary by allowing awareness to conform to its AB belief structure. The outcome of this process is that the AB fades back into the context of ABC or possibly into an underlying prior created AB. Section III of the **Avatar Materials** provides elegant and comprehensive tools for managing any experiences and shifting any boundaries.

REAL = a creation that can be experienced. The more **real** the creation, the more intense the experience can be. Degrees of reality are gradations in the intensity of an experience.

IDENTITY = The Cancel operation can operate in various ways. When it cancels itself from ABC, C becomes a background and BA (bounded awareness) comes to the foreground. The BA state is what we call a BELIEF. It has an IDENTITY -- the definition or boundary shape of a belief or set of beliefs.

VIEWPOINT: Any belief or set of beliefs can be used as a VIEWPOINT for VIEWING other AB's (things, objects, creations, etc.) We also call that kind of belief or belief set a SELF once it is occupied by an observer who is observing (viewing).

OBSERVER = Any Self that engages in viewing or observing (See next definition.)

VIEWING or OBSERVING is a BC transformation by a Self AB during which its A aspect appears to flow through its B aspect (boundary or gap) and conform to another AB. If the A aspect of an AB flows through its B and self-refers, i.e. conforms to itself (its own assumed identity), that is self-referral observation or introspection. Sometimes observing is a form of experience in which the viewpoint (or self identity) retains the belief that it is detached from the AB that it observes. At other times it may identify with what it observes.

ATTENTION is the flow -- or BC-transformation -- of awareness through the FILTER of an AB creation. The B aspect of the AB provides the filtering function, like observing through colored glass or a particular shaped lens or hole. What is observed is usually yet another AB.

Attention, like the Awareness it is made of, has three modalities: Neutral, Attractor, and Repeller. These correspond to ABC's A, B, and C states respectively.

NEUTRAL attention is attention that appears to flow, but actually maintains ABC fully foregrounded however or wherever it flows. Therefore it has no preference for what it observes. It just flows around within itself, exploring its field of all possibilities, and randomly conforming to whatever state or sub-state comes up.

ATTRACTOR attention flows into an AB (or other) creation making it appear more REAL, that is, more foregrounded in attention. The observer AB prefers to observe a particular AB (or other state), so his attention conforms to it and it becomes more real, while other states or creations are backgrounded. Attractor attention makes an AB creation appear more clearly defined, larger, and/or nearer to the observer viewpoint. Attractor attention activates the C operator to cancel specific aspects of distance, separation, and anything that obscures clear perception of the B aspect of an AB creation.

REPELLER attention occurs when an observer AB runs the reversed mirror image of attraction and **resists** the experience of an AB (or other) creation that he has placed attention on. Repeller attention backgrounds (or at least attempts to background) a state or sub-state that was priorly foregrounded. This complementary function of attention has many interesting practical applications that allow us to build a stable physical world to play in. It is the basis for building automatons. The REAL physical world we live and play in is built with the mirrors of imaginary attention and the smoke of creations canceled by OBSCURATION operators. (Examples of Obscuration Operators: "I don't know." "That's impossible.") Resistance is a tool for creating persistent states, wonderful cellular automatons -- including stable elementary particles -- that just keep going and going like the Duracell bunny. **Physics** comes from BC operating on AB's, especially by using repeller attention (resistance). The forces and phenomena of physics are generated by various BC transformations of AB's. Under repulsion an object of observation appears to be backgrounded – becomes more distant, smaller, less distinct.

So undefined awareness defines itself to make the universe, both metaphysical and physical, both subjective and objective, Mind Space and World Space. The above modalities are sufficient to do the whole job. But let's add one more useful definition.

CONSCIOUSNESS is A flowing through any creation that is usually, but not necessarily, an AB self. Consciousness always involves a certain amount of backgrounding. Believing creates beliefs. Consciousness is the process of believing. Consciousness is usually manifested through an AB self, and the physical world derives from AB's interacting via BC's -- various boundary transformations. Paradoxically, ABC itself is not a belief -- which is how we define its undefined nature -- nor is it consciousness. It is undefined awareness. Of course that means we can't say it is NOT a belief either. To talk about it, however, we create a belief and call it "undefined awareness". That belief is NOT undefined awareness, just like Magritte's painting of a pipe is not a pipe. Neither is A by itself a belief, although we can create an idea of A, and that is a belief. CA is unconsciousness. Unconsciousness is another kind of belief, believe it or not.

Belief in ABC (or A or CA) as an idea is an AB. When we think or talk about awareness, we end up in consciousness, by definition.

As you can see from the above, beliefs can stimulate, filter, or react to or transform various other beliefs. (See Palmer, **Living Deliberately**, p. 90.)

IDENTITIES can be rigid or flexible depending on the ratios of ABC in foreground or background awareness. We see by now that foregrounding and backgrounding are artifacts of OBSERVER VIEWPOINTS. What we call reference frames in physics are background (or, if you will, hardcore and often transparent) beliefs that form a sort of foundation, or seed, or skeleton, or stage on which or with which or through which more elaborate belief systems can appear and perform. ABC awareness has no separation of observer and observed. It has no preferred viewpoint at all.

Physical phenomena involving matter, energy, space and time all evolve from BC interactions among various AB "realities". An AB reality is a system of one or more AB beliefs held by one or more observers. Below we see how **persistent attention** is a wave guide for consciousness that can perform power operations on reality. In the quotation below "limitations" represent the "walls" of the wave guide.

Palmer points out (the ABC system described above is mine, not Palmer's):

"A new reality may be defined by a viewpoint already existing within a prior reality. But, if we wish to preserve order, realities defined within existing realities must respect the limitations of the host reality.

"An initial unreality (disorder) occurs when one creates a new reality that violates the limits of the host reality. Persevering through this unreality is essential to expansion and growth."

(**Living Deliberately**, p. 91.)

Palmer's "unreality" corresponds to a disturbance of balance when a belief is asserted that is not aligned with prior beliefs. Such a condition results in a loss of willpower. That is why Palmer recommends perseverance through the "unreality" until it integrates and returns to a state of equilibrium (balance).

You can have as many viewpoints as you like, all coexisting within a shared reality. Viewpoints often correspond to various types of living organisms -- material or energetic or matter-energy systems that organize around a particular point of view and tend to perpetuate that point of view, occasionally "evolving" it to more efficient viewpoints relative to changes in environmental conditions or better understanding of how to explore the preferred viewpoint in a given environment.

Less defined creations often tend to act as source for more defined creations, since creation is a process of definition. Viewpoints are obviously, based on our above discussion, more limited than ABC, which has no particular viewpoint -- or rather

embraces all possible viewpoints. But you can embed as much as you like or are willing to handle.

The cycle of creation or existence thus generally runs like this:

* (ABC) → (BC) → (AB) → (CB) → (ABC).

The creation process involves canceling some portion of the "all possibilities" that form our foundation reality, not poofing something into existence out of nothing or cobbling together old stuff into something new. This view of creation differs vastly from what most people imagine – and is basically the opposite of common assumptions, which is why real creativity is not as widespread as it could be. Armed with this metaphysical foundation and a defined or undefined observer, we can begin to look at physical systems and see what is going on. At least we can explore a few viewpoints.

Newton proposed three basic laws of motion:

(1) **Law of Inertial Frames** -- Newton says, "The *vis insita*, or innate force of matter, is a power of **resisting** by which every body, as much as in it lies, endeavors to preserve its present state, whether it be of rest or of moving uniformly forward in a straight line." Objects remain unchanged in their states of rest or motion unless acted upon by an external force. When so acted upon, they resist changing of state. A "frame" is a space in which an object or system of objects exists. Objects follow the same physical behavior within any non-accelerating inertial frames whether at rest or in non-accelerating motion relative to other frames. All inertial frames are equivalent regardless of their motion, and transformations can be made from one frame to another. But in observer physics we are building a deeper understanding of reference frames. The problem is: Newton has recognized that the physical universe is governed fundamentally by **resistance**. Where does the resistance come from that generates the notion of mass when an external force acts upon something, whether at rest or in motion? We hear of rest mass, inertial mass, and gravitational mass. Are they the same or different? What really is rest mass, since it is invisible unless and until acted upon? Who or what determines a "frame"? How is the frame defined? Why does it exist -- or does it? Without the mysterious "inertial frames" Newton's "laws" become meaningless.

(2) **Mechanical force equals the object's mass times its acceleration (*F = ma*)**. This law only holds in non-relativistic inertial frames, which of course takes us back to the frame question in his first law. Furthermore, this law is really a definition of "mass" as the ratio between two mysterious entities, a **force** (defined as kg m/s^2 -- in other words a **mass** [kg] times an **acceleration** [m/s^2]) and an **acceleration**. As you can see this is a circular definition. Of the three components only acceleration is observable by a truly detached (i.e., objective) observer. For any determination of **force** and **mass** an observer must interfere with the system he is observing so he can "feel" directly or somehow indirectly measure the force, an act that changes the condition of the object under observation, usually by accelerating it or distorting it in some fashion. The observer's angle of viewpoint also can have a significant impact on the acceleration that

she observes. Force and mass are unobservable to a completely detached observer and can only be observed and defined by applying **resistance** to the "observables". This is a clue as to the source of the mysterious resistance Newton mentions in his first law. Perhaps his second law should really be his first law! The only way we can detect "mass" is to apply a force to an object and see how it reacts. This leads us to Newton's third law.

(3) **For every action there is an equal and opposite reaction (F = -F')**. If *A* exerts force on *B*, *B* simultaneously exerts force on *A*, and the two forces are equal in magnitude and opposite in direction. The only way this makes sense is to understand the observer as omnipresent, self-interacting, and responsible for all that is observable. Otherwise, we end up imagining we are in the "Fight Club" beating up others and being beaten up by others. Newton's third law throws light on the notion of inertial frames and the reason why inertial objects resist change. An object may not "resist" change until it has been defined by an observer. That definition creates the mysterious "frame". What the object resists is change of its original definition. So who or what is resisting if the definition of the inertial frame (a frame that is supposed to stay where it was put by someone, I wonder who) was created by the observer in the first place? The stronger and more precise the definition, the more the object resists any change to it. **Permission to change without resistance is obtained only when granted by the observer who originally placed the restrictive and resistive definition.** Thus the resistance of inertial mass derives from the observer's resistance to changing his own definitions. This problem -- which is the source of all suffering -- arises only when the erstwhile observer attempts to change the state of an object he has already previously defined without first granting the object permission to drop its original restrictive definition. Thus creation arises from self-declared words (ideas, beliefs) that define and restrict an initial state of all possibilities. "Frames" are defined spaces that contain defined environments of variously defined and thereby "created" objects.

We now see that Newton's laws are approximations that hold under very special conditions. We also see how thoroughly uninspected these laws have been for the last few centuries by people unwilling to take responsibility for their own existence, behaviors, and experiences. Just because Newton's laws are elegant and exact and give correct results under a wide range of cases and are very useful does not mean we should forget that they are only dealing with a set of special cases. Further inspection and the emergence of new paradigms such as thermodynamics, electromagnetic theory, relativity, and quantum mechanics reveal that Newton's laws describe the physical world as materialistic and governed by forces -- the stuff from which military-industrial empires are made.

Two hundred years later Einstein revealed a context in which it is possible to see one aspect of Newton's "special case" and a larger space in which such a case no longer holds. Quantum mechanics has provided additional viewpoints. We do not know how many other non-Newtonian viewpoints there are that are consistent and useful, but operate in a different domain or different manner. Newton's laws describe the reaction mode of consciousness, just one small step above the superstitious world of mysterious entities,

gods and demons ruling our world of experience.

It is easy to find viewpoints that go beyond Newton. For example, what if there is a universal law that **no observable object remains unchanged indefinitely**? That observation (closer to modern thermodynamics and quantum mechanics) suggests that nature may be a wholeness in which every component ultimately and constantly influences every other component. Also, we can shift our scale or angle of observation without touching or in any way disturbing an object, and that object's appearance and/or its apparent behavior will appear to change drastically. This is a real experience that is unexplained by Newton's second law, even if we use the mathematical spatial transformations that do help to generalize quite a bit. We need observer physics to explain how a physical system that is left untouched can change drastically in appearance by the observer simply switching his viewpoint of observation or his definition or understanding of the object of observation with no other motions or forces involved. In many cases switching viewpoint is almost effortless, and yet the physical consequences in terms of experience can be remarkably different.

Exercise: Redo the "connect-the-dots" exercise we explored in Chapter 1. Find a level of dot-density resolution where you can effortlessly switch back and forth, seeing the ensemble either as a collection of dots or as a line. Play with other popular optical illusions or your beliefs about how things are. Is the reality shift due only to your exercise of will, or are there other factors involved? What do you believe?

I mentioned Newton's reference frame problem. Perhaps we must always include a consideration of the observer and his viewpoint frame in any description of a system. Newton believed there was a universal inertial frame although he could not clearly define it, but Einstein disagreed and believed in no *a priori* frame. Newton's mechanical universe is based on reactions due to resisting forces that bring about change. With study of these mechanics plus a little knowledge of physiology we can arrive at a theory of suffering. As we examine other paradigms of the physical world we may reveal other modes of consciousness available to the observer who chooses not only to observe, but to participate in and experience her physical world.

The way physics is commonly done in the Newtonian paradigm leads to some quite funny situations. I am riding on a merry-go-round. I feel motion, and I see the environment swing by. I feel acceleration of the ride going faster, and I feel a force pulling me toward the outside of the ride. I hang onto a hobby-horse to keep from falling off the ride. The physicist will tell me that the force I experience pressing me toward the outside of the ride's circle is a "fictitious" force caused by the fact that I am in a non-inertial "circular" reference frame, whereas my body is trying to stay in Newton's conservative straight line momentum inertial frame. I only imagine force is there. The Newtonian "reality" is that I am accelerating toward the center of the ride even though I make no progress toward the center. And I do not have any inclination to hurry toward the center of the ride. I am just holding on to keep from sliding AWAY from the center of the ride!! I DO feel that I have mass. This type of physics begins to get counter-intuitive. Newton clarifies that my body mass is in a moving frame relative to

the ground, and will tend to stay moving in a straight line relative to the ground. However the ride's circular motion interferes with the initial straight line momentum. As long as I stay attached to the ride's frame, its circular motion keeps pulling my body mass away from its linear motion into the rides circular motion that always tends toward the center. The "force" I feel pulling me away from the ride's center is the reactive resistance of my body to the change in its inherent linear motion by the secondary motion imposed by the circulating ride.

On the other hand, if I stand outside the ride and watch someone ride on the merry-go-round, I see it turn, but I feel no forces at all. The physicist will describe the event in terms of the "mass" of the riders and the speed of rotation. He will say that the riders are accelerating toward the center of the ride. As an outside observer I feel no mass with respect to the riders or the ride and see no acceleration or relative motion at all on their part toward the center of the ride. Relative to the ride, the riders are at rest. In both cases what the physicist says is happening contradicts what I experience either as a rider or as an uninvolved observer. And physics is supposed to explain our experiences!! Why is it that physics often insists on explaining experiences in ways that do not correspond to our experiences? The rider is in one frame, the outside observer is in another frame. Each observes and feels the events differently.

What I experience is that no object inherently has mass. The mass of any object is inherently undefined, whatever its apparent acceleration may be, just as two objects of greatly different mass appear to accelerate at the same speed in the same gravitational frame. Isn't that what you experience? So we have a fundamental principle of observer physics:

Principle: Mass is an illusion caused by resistance in an observer. No object has any inherent mass.

Corollary: The notion of "rest mass" is a fictitious mathematical artifact used for doing certain calculations in physics. No object has mass when it is truly at rest, and no object is ever truly at rest. The same applies to Einstein's formula for the rest mass of quantum particles. The best value of E and m in Einstein's rest mass equation depends on our ability to measure the results of a particle's mass-energy conversion. If Newton's F, m or a are zero, the relation of these three properties of matter is indeterminate or nonexistent.

Experiment: View a video of a bowling ball and a feather dropped at the same time from a height in a vacuum chamber. If the bowling ball had a mass close to that of Earth, would the results of the experiment be the same?

The appearance of mass is an artifact generated by some form of resistance. When we observe from a detached position we have a habit of imagining fictitious forces by analogy to situations in which we resist, and therefore experience, "force". Perhaps there is an equal and opposite action-reaction. An inertial mass resists change and tries to continue its original motion in a straight line. Something else pushes or pulls on it, forcing it to follow another path. The stress is due to a conflict of definitions, one

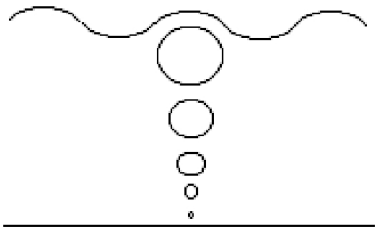
saying "go straight" and another saying "go in a circle around this central point".

The centrifugal forces are imaginary to an outside observer using Newton's laws, because in a non-inertial frame the first law does not hold. But people are still thrown about and scream as a roller coaster swerves. It seems as if Newton's laws sometimes become more important to scientists than a description of experience. Even from outside I can see and hear the people scream. I can't see the centripetal force, but it's real. I can see and feel the centrifugal force's effects but it's not real. That's strange. Resistance in the observer who is riding in the system and subjecting himself to these forces creates the discomfort. On the other hand, if his awareness is expanded and relaxed, his body may seem to move around, but he will not feel any "force". He will just feel waves of experience. Some people scream, and some just enjoy the ride.

In most experiments the detached observer scientist uses tools to connect himself into the experiment indirectly so as to measure what's going on. The tools feel the forces by proxy for the observer and then report back to the observer's quasi-detached reference frame the reality they experienced. If I fire a gun myself, I definitely feel the forces involved. They are real and $F = ma$ may hold. In that case I have placed myself in a position of resisting the event, so it gives me a jolt in the shoulder.

We detect the force that pushes the bullet forward by the kick of the gun backwards. That is Newton's third law. It is also a restricted viewpoint. The so-called equal and opposite reaction is not a second event -- object two pushing back. It is only the action itself expanding its territory of influence outward throughout the universe in all directions like ripples from a rock dropped in a pond or photon wave-particles spreading from a light flash. The gunpowder explodes and expands hot gases in all directions, pushing the bullet in one direction and the gun in another. The gun's kick is not a reaction, it is the rippling of the bubble of the same action that drives the bullet, just rolling through a different medium in a different direction. The gas pushing the bullet and the bullet pushing the gas also form a bubble, and those two components -- gas and bullet -- gradually expand in all directions as a subsystem bubble. The gun barrel acts as a wave guide to keep much of the event within its borders. We see this principle all the way down to the quantum level, where correlated quantum particles emitted from a source are really just the ripples from a bubble event that is expanding in space/time like light radiating from a light bulb. All inertial events occur as expanding bubbles in ABC.

The Maharishi represented this idea for consciousness in an extremely general way with a drawing he called the "bubble diagram". It shows a pond with little ripples on its surface. At the bottom of the pond tiny gas bubbles form, perhaps from decaying material. At a certain critical size, the bubbles leave the bottom and begin to rise toward the surface. As they rise, the water density decreases, and the bubbles expand, growing larger and larger. At the surface they pop causing little ripples. This is a physical analogy Maharishi used for a process that also occurs in awareness. The bubbles are thoughts -- beliefs. The belief bubbles grow in the mind as they rise toward surface awareness, AB waking consciousness. Then they breach the surface and become experiences.



According to Newton, acceleration is a ratio between the force on an object and the object's mass. However, we can't see the force. (Sometimes we can see symptoms of force.) We only see the acceleration. No objects have any mass unless they resist something. If F is 0, then $m = (0/a) = 0$. Inertial mass is a resistance to a change in velocity.

Newton **assumes** that objects innately resist change in velocity.

This is a transparent belief at the basis of Newtonian mechanics. Thus mass may be an outcome of the first law. But this may not be true in all cases or all the time. Why should things resist a change in velocity? They do not always do this. Phase waves are observable, but the do not resist change in velocity. Look at the example of the phase waves in a klystron tube. They are without mass and can whip back and forth in the rectangular tube at superluminal speeds, with huge instantaneous changes in velocity. Attention scanning doesn't have to resist change in velocity either.

Exercise: Watch a movie and pay particularly close attention to the motions of the people, vehicles, and other objects. You get the illusion that they are moving, and indeed the images ARE moving. But they have NO MASS. The illusion can be very convincing, because the image of a car moving on TV recalls your experience of being in a car. You **identify** in your imagination with the experience of the person in the car in the movie. But the "reality" is that there are only electrons and photons interacting via phase waves that are projected onto the screen. If a car crashes in a movie, you do not feel anything. There is acceleration, but no mass, and no force. Yet we could plug in values for Newton's second law and describe it -- maybe. Try looking at computer generated animation in a video game with action and fighting. Watch carefully, and you will notice that the motions of the characters look pretty good, but do not really reflect properly the motions that occur under the influence of earth gravity. The gradual encroachment of 2D and even 3D "virtual realities" into our environment makes this liberation of our awareness from Newton's hidden assumption about inertial mass and "force" extremely significant. How many hours a week do you spend watching TV or movies or playing video games? George Lucas, Steven Spielberg and many others are making large buckets of cash by exploiting their understanding of this hidden assumption in physics through the use of various technologies.

The Maharishi uses another "analogy" that has bearing on this issue. You can actually do a demonstration of this analogy as a physical experiment.

Experiment: Take a sharp kitchen knife and press its sharp blade edge against a piece of wood. Now press it against a stick of butter. Now pass the knife through water. Finally, slice the knife through the air. What's the difference? Resistance. Now place first the wood, and then the butter, on a scale and weigh them. They both have a similar weight. What's the difference with respect to the knife blade? Resistance. You can not detect mass without resistance of some kind. This is the real meaning of Newton's third law. In one case the molecular bonds in the butter have less resistance to the knife blade than the molecular bonds in the wood. The molecular bonds in both objects are sufficient to treat both objects as whole units resisting the scale pan as they move toward earth's gravitational singularity. With a superconductor, you can not detect the presence of the wire by means of its resistance when it conducts a current of electrons. The current might as well be flowing through empty space.

So we must rewrite Newton's second law to include the position of the observer with respect to the system he is observing and the roles of any resistances involved. If the observer is in the powder, he's at the epicenter of the bullet-firing event and he'll be blown up. He'll expand for a while, and then slow down, passing on heat and energy to surrounding air and other materials that resist and absorb his expansion. He doesn't really go anywhere; he just puffs up suddenly and becomes rarefied. If he's not killed, he sees the bullet and gun separate, but much more slowly than an outside observer, because he is expanding along with their system for a while. If he's the bullet, he'll accelerate very rapidly to a high speed (a_b); if he's the gun, he'll accelerate less rapidly to a slower speed (a_g) -- unless he has no external reference frame other than the gun and bullet. Then his perceived acceleration (in either case) will be the two accelerations combined, ($a_b + a_g$). Both gun and bullet have the same acceleration from each others' viewpoints!!

Perhaps our observer can observe the powder and calculate where the epicenter is from its expansion bubble. But that will be unlikely, because the bubble will not expand evenly due to its varying densities and the material around it. So in this fairly simple example of firing a bullet from a gun, $F = ma$ only seems to work for someone who imagines the forces existing but can't directly detect them. We have assumed that the gun and the bullet somehow can figure out their masses, a difficult task if they only have the firing of the gun to use as their judge of mass. How does an observer detect their masses if the experiment is done in free space? He must use an inertial method, which assumes $F = ma$. A detached observer with a relatively non-dense space between himself and the event can tell where the epicenter is and will see that the acceleration relative to the epicenter is different for gun and bullet. He has a ratio. So $F = ma$ might work for him if he can figure out how to measure the masses without touching them. Ironically, he will detect no forces unless he interferes with the experiment and gets "intimately" involved. From a detached position he will just receive a pattern of photons the way an astronomer does from an event in a far-off galaxy. He may also hear a bang. But how can you get mass from a bang or an image appearing to move orthogonally (or at some angle that but for some other assumptions might as well be orthogonal) to your line of sight. What's the difference between that and watching TV? The TV image is an illusion and may have been computer generated for all you know.

All apparent motions are orthogonal to your line of sight, regardless of what you imagine is happening “on” or “in” the screen space.

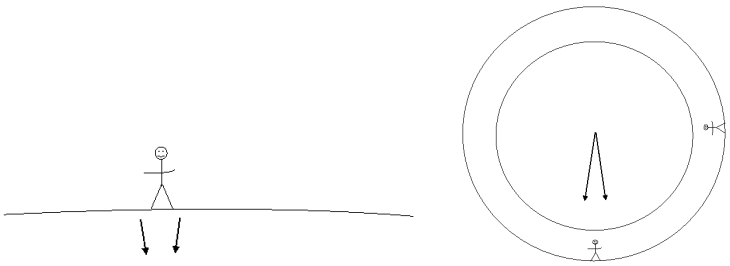
We are living in a world with evolving understanding of technology that leads us to suspect more and more that we may have been hoodwinked. In fact we may have hoodwinked ourselves into believing a lot of strange things that do not hold up under careful scrutiny.

Here's another interesting example. Einstein posited that acceleration and gravity were indistinguishable. However, though they are uncannily similar in some ways, they are NOT identical, in spite of Einstein's declaration of the so-called equivalence principle.

Einstein claimed that the effect of "real" gravity's force is the same as that of the "fake" inertial force. This principle is like Newton's laws. It works, but only within a very small range of observation. It is like the tangent point of a circle and a line. The curve and the line touch only at the tangent and resemble each other only within an arbitrary closeness to the tangent. Who would claim that a straight line is the same as a curve? That's exactly what Einstein did with his theory of geodesics.

The tidal forces and dimensionality of gravity and inertia are not the same.

If we have an elevator or rocket that "rises" in a straight line with a rapid acceleration, the force vectors are parallel. The gravitational "force" vectors from the center of Earth's mass are radial. (See sketch below.) They are different, because the definitions of the physical systems involved are fundamentally different. "Rest mass" is an oxymoron and a "back formation", because we are unable to measure mass without first causing a change in an object's state of relative motion.



Man on Earth Man on Rotating Space Station

Now let's imagine a giant cylindrical space station -- a large Newton bucket -- that is rotating along its longitudinal central axis. This will generate a very obvious and useful (but "fictitious") force of "artificial" gravity that enables the astronauts to walk about on the inside of the outer wall of the cylinder. This force is due to inertial acceleration, not gravity. As the station turns, at any arbitrary point on its perimeter wall the station's motion is tangent to the perimeter. But the fictional "forces" at the point are orthogonal to that tangent trajectory and form a ray from the cylinder's center passing outward through the point. The centripetal and centrifugal forces push in both directions equally, the wall pushing toward the center and a component of a person's inertial momentum pushing away from the center. Loose objects, like astronauts, will be pushed outward

onto the perimeter wall as if there were gravity "out there", while the attached wall of the station will push inward and keep the astronauts in the cylinder. The astronaut's body actually wants to go tangent to the wall, but the wall keeps swerving toward the center of the station as it turns. The wall wants to fly "outward" too, but is held in place by the molecular bonds in its structure. An astronaut will thus adhere to the wall, and these two objects (astronaut and wall) will push against each other with equal and opposite force. As the astronaut walks about the station, the top of her head will point inward, and the bottoms of her feet will point outward. She will feel as if she is walking in a normal gravitational environment. The only weird thing will be that the floor keeps curving slightly "uphill". She may not notice, but the inertial tidal forces will spread out as they pass through her from head to feet as opposed to the earthly tidal forces that converge as they pass through an Earth-bound person.

Although the gravitational tidal forces will gather together as they pass from the Earthman's head to his feet the two forces are still different. The space station's centrifugal field will appear to be a flat, two-dimensional ring with rays extending only in a plane -- though the plane can be stretched out into a cylindrical space by sliding the ring along the cylinder's axis. The earth's gravitational field will be a three-dimensional sphere with rays extending in all directions of 3-space from the singularity of the gravitational core.

Acceleration produced by kinetic motions appears to generate "tidal effects" in one or two dimensions only, unless there is an explosion. That is because we can channel kinetic effects with wave guides -- otherwise they always tend to be explosive. The rotating space station is a wave guide. So far we are unable to channel gravity with a wave guide. It always appears omnidirectional toward a center of mass. Acceleration due to gravity always produces tidal effects only in three dimensions that we are unable to channel. Thus, inertial mass and gravitational mass behave quite differently. They both derive from the observer's imposition of a definitional force, but occur at different stages or viewpoints in the creation process (as we shall see more clearly later). Rest mass also derives from a fundamental definition imposed on an object, but is unobservable until acted on. It is the core belief from which gravitational and inertial mass derive at different scales of creation. As Einstein discovered, rest mass is the fundamental ratio of potential energy to the self-interaction of light ($m_0 = E/c^2$). So rest mass, gravitational mass, and inertial mass describe the same quality of resistance to change of definition, but at different stages of creation.

However, in all of these tidal systems density plays a key role. In any system that manifests kinetic acceleration (such as the gun and bullet system or a rocket), the whole system expands and rarefies. The average density of the whole system drops, and this is often thought of as an increase in entropy. The observer generally fixates on the rocket and forgets about the exhaust, or fixates on the bullet and forgets about the powder and gun. The rotating station appears to be in equilibrium, but is actually expanding bit by bit because rockets or some other devices are used to give it its initial spin. The rockets spew exhaust out into space in all directions, effectively expanding the phase space of the whole system.

Thus we discover that gravitational acceleration serves as the opposite of kinetic acceleration. With gravity the whole system contracts and "densifies". Observer physics proposes a simple reason for the "behavior" of gravity. Gravity is not a force, because all forces are resistive. Gravity is the relaxation of a priorly applied force. The universe, as the name implies, is a unified wholeness that turns in on itself. Unity is inherently boring and lonely. So the observer resists unity and fractures it into diversity. The force of that resistance generates the Big Bang. Yes, believe it or not, we as one awareness all caused the Big Bang so that we could splinter ourselves into a multiplicity of entities all interacting together as separate individuals. So gravity is the ultimate fictitious force. The Big Bang resistance is a global explosive fit of anger and frustration or perhaps playful whimsy. In any case, it took a tremendous focus of attention for an extremely tiny moment. Once the momentum got going and diversity began to show up, attention left the Big Bang effort and began to focus on local objects and events. Since unity is the foundation of the universe, as soon as the universal resistance let up and switched to local resistances, the essential wholeness of the universe began to reassert itself against the fictitious diversity, and all the parts began to fall back into the unity that preceded the Big Bang like a stretched rubber band returning to its original shape. So now we have a universal tendency of all physical parts of the universe to collapse back toward the Big Bang initial condition, while local attention occupies itself locally here and there throughout every nook and cranny of the universe.

Many details of how the invisible Big Bang unfolded into an experiential physical universe are already known by humans, but certain key details are still not well understood, so we will cover some of them in later discussions. But for now it is enough to understand that the physical universe exists and evolves due to resistance. It is no wonder that most people are very resistant to the notion of unity, because they innately recall the boredom and loneliness it entails. The goal of evolution appears to be achieving a recognition of underlying unity while at the same time enjoying the creativity and amusement of unlimited diversity. It gets interesting and challenging when the identity of individual *A* creates encounters with an identity *X* that is so far out of *A*'s belief system box that serious resistance sets in. An identity is an attention wave guide constructed from beliefs that enables some form of consciousness to operate experientially in time, space, and other dimensions of awareness.

A solar system becomes stable when material collects in orbits at proper densities, and the whole thing runs primarily as a looping feedback of gravitational influences between the solar star and its planets in equilibrium between kinetic accelerating expansion and gravitational contraction. The "mass" of a planet has nothing to do with the size of its orbit. The orbit seems to be determined primarily by initial momentum. Electron orbits also are stable unless pumped or sucked from outside. But in the case of charged particles the "gravitational" acceleration usually is mostly replaced by an electromagnetic acceleration. What is the connection between these? We will explore that major question shortly.

Kinetic inertial acceleration expands a system and heats it. When an electron drops to a

lower orbital, seeming to contract, a photon is given off and the system actually expands, although the local component electron appears to cool and contract its level of activity. Our notions of entropy are related to this. (In Chapter 14 we will explore some aspects of thermodynamics and entropy in the light of Observer Physics.)

Gravitational acceleration contracts a system. In a system dominated by what we will call a gravity well the 3D acceleration of satellite material is an implosion toward the core, and density tends to increase as you approach the core. Actually the little singularities that are falling inward toward the core compete with the big solar singularity but they lose the contest. In the sense that they spontaneously contract, gravitational systems seem to violate entropy. They also make a steady-state universe illogical. It would implode. Hence the necessity for Big Bangs. The Maharishi, with his flair for generality, pointed out that "immortality" only makes sense as **dynamic** immortality.

More density in the core generates more gravitational "pull" (relaxation). On the other hand, an object pulled in may reach a point where it is less dense than the gravity system, in which case -- depending on its relative speed and density -- it "floats", or smashes itself, or "skips" like a flat pebble on a pond's surface when it reaches a certain level in the system. Recently cosmologists have introduced a theory of inflation and the possibility of negative density. This is very relevant to the role of gravitation, both at big scales, and also at small scales in the vacuum state. It can also be a source of unlimited "free" energy. Any idea of positive density (or temperature) implies the possibility of negative density (or temperature.) We have just begun to explore such possibilities.

My suspicion is that the limited one and two-dimensional appearance of inertial systems is an illusion caused by the observer taking a certain viewpoint with fixed attention on a particular aspect of the system. As I discussed earlier in the gun example, any event involving inertial acceleration is a **bubble** in undefined awareness that expands and ripples throughout all of creation (the whole macro-AB structure.) If this view is correct, then we can indeed propose that inertial acceleration is the complement to gravity. It is the "fictitious force" of antigravity. It just looks complex or limited due to extreme density variations and interposition of other forces as opposed to the more usual smooth density variations in gravity systems.

Gravity holding us on our planet is an artifact of where our attention has been lately and not a general principle. A practical demonstration that this is true is our ability to shoot rockets out into free space beyond the grip of earth's gravitational field. These rockets are still in earth's "grip", but other celestial bodies plus "escape" velocity ensure that such rockets will not return to earth.

Thus I propose that the expanding force of inertial kinetic acceleration generated by resistance is really the conjugate mate -- the opposite pole -- of the contracting relaxation of gravity.

If we go back to our discussion of attention, we find that attention can be moved about

effortlessly, though at times, when influenced by fixation or resistance, it may not. Attention has the ability to function with no apparent mass. However, it can also generate mass, just like gravity, by focusing in a relaxed manner. Focused attention gathers density, and hence "reality", onto an object of attention.

On the other hand, we can also defocus attention by deep relaxation. For example, when we sleep, attention is defocused. That's why we do not remember what happens during sleep. We may consider sleep too boring (a limiting belief?) to remember what goes on, except when we slip into a vivid dream. When we allow attention to transcend an area of focus, attention is also defocused. The difference is that in the former case awareness is canceled (backgrounded) and in the latter case awareness is foregrounded while boundaries and will are backgrounded.

Exercise: Do exercise # 26, "The Expansion Exercise" in **ReSurfacting**.

Imagine the attention in a very expanded state so that it can encompass the entire universe and far beyond. To the extent you can imagine it you are doing it. If focused attention gathers density, defocused attention gathers "anti-density". In this way it can act just like antigravity to "stand" outside and suck things outward toward greater expansion. This tends to reduce the density of a physical system and brings up interesting cosmological problems related to inflation, the Hubble "constant", and the relation of gravity to the expanding cosmos.

When you burn something or blow it up, its density greatly decreases and a good portion of the system may "go up in smoke." Can we operate deliberately on that level with our attention? (Or does that make us into terrorists?) We know it is possible to imagine such expanded attention. Does the ability of attention to be massless mean that it can easily function as a superluminal phase wave? Taking note that there may be a difference between attention operating in perception and attention operating in imagination -- if you believe there IS such a difference --, do you think we can harness these operations to generate new types of reliable physical phenomena? I think that from the above discussion, and with a development of Observer Physics and further exploration of ansible* principles that the answer to all these questions is -- yes! What do you think?

* The "ansible" is a term coined by science fiction writer Ursula Le Guin that refers to a device for communicating over great distances faster than light (FTL).

Notes:
In sections 4 and 5 of his lecture number 48, entitled "Beats", Richard Feynman discusses localized wave trains and probability amplitudes for particles. There he considers the relationship among (c), (v_g), and (v_p), analyzing it in a different way, but comes up with the same velocity relationship -- although he does not write out the equation in the same way we do in this essay.

For a survey of what the "establishment" thinks about superluminal communication, read

Nick Herbert's **Faster Than Light**. Herbert very much wants to find the FTL secret, but, because he wears Einstein blinkers, he ironically is unable to see that he himself has mastered the art of FTL communication to a high degree, as his book, by its existence, testifies.

Extra Exercise: Think of some other examples of superluminal phase wave communication that we humans commonly use in our current civilization. Some possible answers are given below.

Some Suggested Answers:
Marquee messages can move at any speed by programmed timing of their lights. A marquee can even simultaneously blink on an entire display of lights in the desired pattern to spell its message. Physicists claim no message can be sent **along** the row of lights, and that is correct. However, the marquee is designed to function as a sign, and the message is easily read by those who stand at 90 degrees relative to the plane of the sign and at a distance where they can see all the lights at once. The light from the bulbs travels at light speed, but the reader gets the message from the entire communication channel (row of lights) in one glance faster than light speed as the image from the entire set of bulbs transfers simultaneously onto his retina. In similar fashion:

* Building a house is in group wave mode; living in a house is phase wave mode.
* Making clothes is group wave mode; owning a wardrobe is phase wave mode.
* Getting dressed is group wave mode; wearing clothes is phase wave mode.
* Playing a melody is group wave mode; playing chords is phase wave mode.
* A plucked guitar string is phase wave mode; it has many simultaneous harmonics.
* Writing a book is group wave mode; printed books and libraries are phase wave mode.
* Media speech is group wave mode; media broadcasting is phase wave mode.
* Mass transit vehicles such as airplanes, trains, and buses operate in phase wave mode by simultaneously delivering large groups of people from point A to point B.