

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

OP draws on a mathematical tool that has been somewhat neglected in the primarily Cartesian dominated world of science -- the Projective Geometry (PG) developed by Desargues, Poncelet 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 of his painting. It goes much deeper than that.

The PG way of doing geometry brings out the principle of "Duality". 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 O. Whicher, **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. 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."

Usually physics is very concerned with measurement. The Cartesian approach with its analytical geometry fits this particular interest nicely. PG is not so interested in measurement, but explores how forms spontaneously arise from the interaction of nonlocal phenomena. This is an idea very suited to quantum mechanics.

For example, 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 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. 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.

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.

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.

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. 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

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. Mach may be on the right track, but a simpler explanation 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 relative to some level 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. We can calculate the changes that occur in Newton's bucket experiment from the observer's frame as 'Prime Mover'.

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

The water is a set of many microscopic loose particles, and the bucket functions as a **SINGLE** macroparticle. The participating observer Prime Mover has set the bucket spinning. Slight friction between the bucket's surface and the water particles imparts momentum to the water particles. Each 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 surface. Using Newton's equations we can calculate the concave shape of the water's surface. The bucket serves as a wave guide. What is the dynamic of a wave guide?

Let's 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.

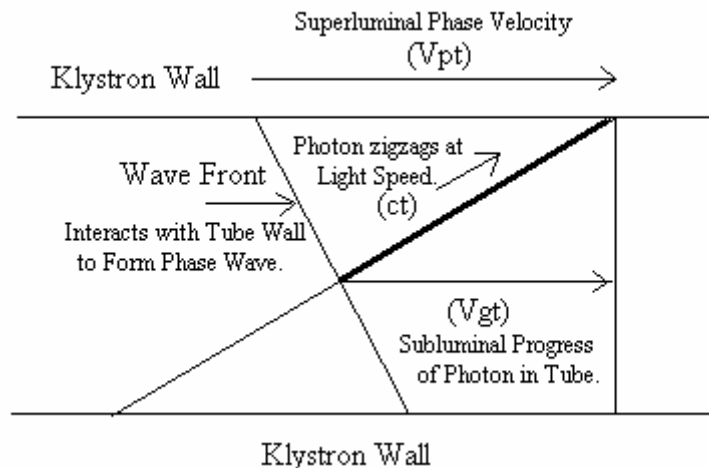
First a word about what wave guides are. Wave guides are expressions of a powerful

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 awareness, -- 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 attention is a wave guide.

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 subluminal and local, whereas phase waves are superluminal, holistic, and non-local. The relativistic conversion formula between local (group) waves and non-local phase waves is.

$$* \quad (Vg)(Vp) = c^2.$$

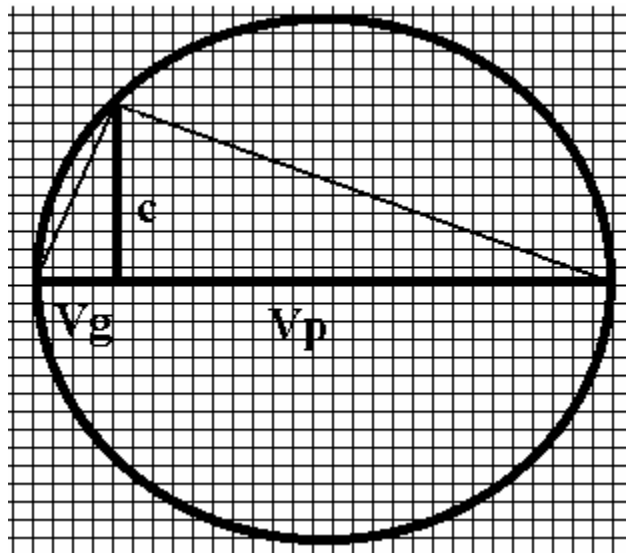
Here is a sketch of a klystron wave guide used in microwave technology. It shows the relationships of the three wave types. (Vg) is the group velocity, (Vp) is the phase velocity, and (c) is the photon moving at the speed of light. We convert velocities into relative distances by multiplying each velocity by a constant unit of time (t) which we can then cancel out of the equation.



In the klystron tube, (Vg) and (Vp) 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. (Vg) is the photon's net forward progress. (Vp) represents the interaction of the photon's wave front with the tube wall. This interaction is a non-local phenomenon. The wave front is always normal to the photon trajectory. You can see from the geometry that (Vp) is always greater than (c) , and (c) is always greater than (Vg) -- 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 can not move or even manifest. The curious thing about the relationship between the photon and its terminals is that it always moves at (c) relative to its terminals, regardless of their positions or any other relative motions. It balances the differences by shifting its apparent wavelength rather than its speed. (See 6-19 for other derivations of the relation.)

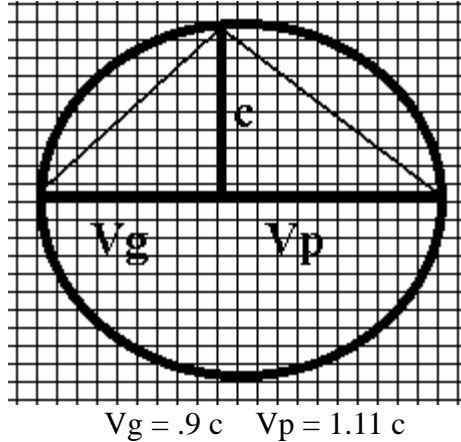
Another way of schematically representing the velocity relationship is to imagine a circle centered at the origin and divided into an upper and lower half by a horizontal diameter along the x-axis. Any position on the circumference of the circle can represent a set of values in the Velocity Equation.



$$V_g = .4 c \quad V_p = 2.5 c$$

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 that show the Velocity Relation. The vertical line is of constant size from circle to circle, so the circumference may change depending on the position of the vertical arc relative to the circle's center. Lines above the diameter represent "retarded" light coming to the observer, and lines below the diameter represent the "advanced" light of the observer's attention going to an object. The light pole divides the diameter into two sections. If they are even, then the diameter represents an electromagnetic signal traveling through 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.

* $E = M c^2.$



Newton's bucket is a rotating cylindrical wave guide.

Contemplate the bucket experiment. It is simple, but profound. It takes us into the fundamental problem of inertial motion. When we have a full-fledged relativistic theory of quantum gravity in chapter 15, we will be able to come back and get a deeper grasp of this "homework".

We need to observe in a broader context to get to a fundamental motivation for motion and the force(s) that manifest(s) it. 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 OP we step back from physics and begin with something I suppose you could 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 let 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 this essay Palmer succinctly lays out the fundamental principles of a science of Being.

Let's begin with a primitive that simply exists. We can label it BEING. We have no idea what it is, but we will give it a name 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 more 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 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 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 or 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, 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 Cancelled. This is the illusion of Dullness, Ignorance, Sleep, Death, inert matter, and any state where we imagine that we have cancelled awareness. Ironically, by canceling (A), we end up foregrounding it, and (B) is backgrounded. (AC) is therefore a state of extreme pretense.

BC = Boundary Cancelled/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. A (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.

OBSERVER = Any Self that engages in viewing or observing.

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.

ATTENTION = The flow -- or BC-transformation -- of awareness through the FILTER of an (AB) creation we call ATTENTION. The (B) aspect of the (AB) provides the filtering function, like observing through colored glass or a particular shaped lens or hole.

Attention, like Awareness (which is what it is made of) has three modalities: Neutral, Attractor, Repellor. 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.

REPELLOR attention occurs when an observer (AB) runs the mirror image of attraction and resists the experience of an (AB) (or other) creation that he has placed attention on. Repellor attention backgrounds 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 automaton. 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 automaton -- including stable elementary particles -- that just keep going and going and going like the Duracell bunny. **Physics** comes from (BC) operating on (AB)'s, especially by using repellor attention (resistance). And all the forces and phenomena of physics are generated by various (BC) transformations of (AB)'s.

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 a 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 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 beliefs held by one or more observers.

Palmer points out:

"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.)

You can have as many viewpoints as you like, all coexisting within a shared reality.

Less defined creations usually act as source for more defined creations. Viewpoints are obviously, from 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).

Armed with this metaphysical foundation and a defined 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 -- Objects remain unchanged in their rest or motion unless acted upon by an external force. All inertial frames are equivalent regardless of their motion. Well, the bucket was a problem. But in observer physics we are building a deeper understanding of reference frames.

(2) Mechanical force equals the object's mass times its acceleration ($F = MA$). This law only holds in non-relativistic inertial frames.

(3) For every action there is an equal and opposite reaction ($F = -F'$). If (A) exerts force on (B), (B) exerts force on (A), and the two forces are equal in magnitude and opposite in direction.

We now see that these laws are approximations that hold under very special conditions.

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. Einstein revealed a context in which it was possible to see one aspect of their "special caseness" and a larger space in which they no longer hold. 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.

It is easy to find viewpoints that go beyond Newton. No object remains unchanged indefinitely. That observation violates his first law. 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 drastically change. 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 and with no other motions or forces involved.

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. 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. Actually we see now that we must always include a consideration of the observer and his viewpoint frame in any description of a system.

The way physics is commonly done leads to some quite funny situations. I am riding on a merry-go-round. I feel motion, because 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 reference frame. I only imagine it is there. The "reality" is that I am accelerating toward the center of the ride. Yet I am just riding, and do not feel like I am hurrying toward the center of the ride. I am holding on to keep from sliding AWAY from the center of the ride!! I DO feel that I have mass.

On the other hand, if I watch someone ride on the merry-go-round, I see it turn, but 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. Yet I feel no mass with respect to the riders and see no acceleration or relative motion at all on their part toward the center of the ride. In both cases what the physicist says is happening contradicts what I experience. 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?

What I experience is that no object inherently has mass. The mass of any object is inherently undefined, whatever its acceleration may be, just as two objects of greatly different mass 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 at rest.

Experiment: Make a ramp and select two balls of the same size, but varying density. For example, choose a steel ball and a wooden ball. Roll them both down the ramp at the same time. The masses involved in both cases can vary quite dramatically, and yet you will see them follow the same trajectory. Note: If you use styrofoam or some other very light substance for your ball, you may have a distortion of your results due to the effects of air drag. In a vacuum this distortion disappears.

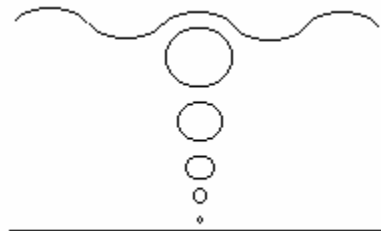
The appearance of mass is an artifact generated by some form of resistance. When we observe from a detached position we have a habit of imagining fictitious forces by analogy to situations in which we resist, and therefore experience, "force". On the other hand, physicists like to tell us that inertial forces -- such as we feel when riding on a roller coaster -- are "fictitious" even though we may barf in a bag from the effects. These fictitious forces sure feel real. Isn't that a bit odd? Physicists say that there is a difference in viewpoint.

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. 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 on roller coaster rides. I can't see the centripetal force, but it's real. I can see the centrifugal force's effects but it's not real. That's strange. I do agree that resistance in the observer who is riding in the system and subjecting himself to these forces creates the discomfort of these forces. 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.

In most experiments the detached observer scientist uses tools to connect himself into the experiment indirectly and 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. But 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 waves 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 as a subsystem bubble. 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. All inertial events occur as expanding bubbles in (ABC).

Maharishi represents this idea in an extremely general way with a drawing he calls 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 quantum 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 uses 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. We only see the acceleration. No objects have any mass unless they resist something. 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 don't resist change in velocity. Look at the example of the phase waves in the klystron tube. They are massless and can whip back and forth in the 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 "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 secret understanding of this hidden assumption in physics through the use of various technologies.

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 blade edge against a piece of wood. Now press it against a stick of warm 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 similarity? 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. In the other case, 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 through 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. He doesn't really go anywhere; he just puffs up suddenly and becomes rarified. 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, $(A_b + A_g)$. So 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 the varying densities of 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. 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) 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.

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 a rocket that blasts off in a straight line, we get an apparently one-dimensional tidal force that pushes in the opposite direction. The pilot is pressed down against his seat.

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 wall of the cylinder. This force is due to inertial acceleration, not gravity. As the station turns, at any arbitrary point on its perimeter the station's motion is tangent to the perimeter. But the 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, toward and away from the center and keep the tangent point rotating about the axis. Loose objects, like astronauts -- the water in Newton's bucket --, will be pushed outward, while fixed objects -- the wall of the station and Newton's bucket -- will push inward. The wall wants to fly outward too, but is held in place by molecular bonds in its structure. An astronaut will thus adhere to the wall, and these two objects will push against each other with equal and opposite force. The result will be in equilibrium unless the spin increases until the astronaut's outward push is stronger than the molecular bonds in the wall. As he walks about the station, the astronaut's head will face inward, and his feet, outward. He will feel as if he is walking in a normal gravitational environment. The only weird thing will be that the floor keeps curving slightly "uphill". He may not notice, but the inertial tidal forces will spread out as they pass through him from head to feet.

On the other hand, a person standing in the gravity of the earth on the earth's surface will stand with feet facing earth's core and head pointing outward. The gravitational tidal forces will gather together as they pass from his head to his feet. Furthermore, the space station's centrifugal field will 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 generates "tidal effects" in one or two dimensions only. Acceleration due to gravity produces tidal effects in three dimensions. Dimension one is a force opposite to the direction of the object's motion. Dimension two produces a "contrail" that is orthogonal to the orbiting motion (making a plane) and pushes in opposite directions (centripetal for "bound" objects and centrifugal for "loose" objects.) Dimension three generates motion toward a center, regardless of whether objects are bound or loose.

But in all of these tidal systems density plays a key role. In any system that manifests kinetic acceleration (such as the gun and bullet or a rocket), the whole system expands and rarifies. The average density of the whole system drops. 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 are used to spin it. The rockets spew exhaust out into space in all directions, effectively expanding the phase space of the whole system.

Gravitational acceleration is the opposite of kinetic acceleration. The whole system

contracts and "densifies".

A solar system is pretty stable because material collects in orbits at proper densities, and the whole thing runs primarily as a looping feedback of gravitational forces between the star and its planets in equilibrium between kinetic accelerating expansion and gravitational contraction. Electron orbits also seem pretty stable unless pumped or sucked from outside. But there the "gravitational" acceleration is replaced by an electromagnetic acceleration. What is the connection between these? We will explore that question shortly.

Kinetic inertial acceleration expands a system. When an electron drops to a lower orbital, seeming to contract, a photon is given off and the system actually expands. Our notions of entropy are related to this. (In Chapter 14 we explore 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 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. Maharishi, with his flair for generality, points out that "immortality" only makes sense as **dynamic** immortality.

More density in the core generates more gravitational pull. 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 germane 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 true "force" of antigravity. It just looks complex or limited due to extreme density variations as opposed to the more usual smooth density variations in gravity systems.

This 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 bodies plus "escape" velocity ensure that the rockets won't return to earth.

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

If we go back to our discussion of attention, we find that attention can be moved about effortlessly, though at times it may not. So attention has the ability to function with no apparent mass. However, it can also generate mass, just like gravity, by focussing. Focussed attention gathers density, and hence "reality", onto the object of attention.

On the other hand, we can also defocus attention. For example, when we sleep, attention is defocused. That's why we don't remember what happens during sleep. We consider sleep too boring (a limiting belief?) to remember what goes on. When we transcend, 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. 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 OP 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).

Other Derivations of the Einstein/de Broglie Velocity Equation

An oscillation has an amplitude, wavelength (L), a frequency (u) or period ($T = 1 / u$), and a phase (ph). Fourier showed that in general we can represent any function as the superposition of a set of periodic oscillations. If the oscillation has a time evolution, then it produces a train of waves that move along at a certain velocity, which is the wavelength times the frequency. Since this represents a displacement of the wave's phase through space over time, it is called the phase velocity.

* Phase Velocity: $(V_p) = (L)(u) = (L) / (T) = (w / k)$, where $(k) = 2 P / L$; $w = 2 P / T$.

$$(P = \pi = 3.1416.)$$

In 1924 de Broglie showed that any particle of matter such as an electron also could be interpreted as a wave packet -- that is, a superposition of pure periodic oscillations that generates the appearance of a lump that behaves like a localized particle. His reasoning was based on the Einstein-Planck relations that show how the energy of a photon depends on its frequency times the universal constant of wave resolution (h) and Einstein's famous equation showing the mass-energy relation.

- * $E = (h)(u)$.
- * $E = M c^2$.
- * $M c = (h) (u) / c$.
- * $u / c = 1 / L$
- * $M c = h / L$
- * $L = h / M c$.

Taking (Me) as the mass of the electron and letting (c) become the velocity of the electron (Ve), we get the de Broglie wavelength of the electron (Le).

* $Le = h / Me Ve$.

This can be expressed as the group velocity of the wave packet forming the electron (Vg).

* $Vg = h / Me Le$.

Substituting the mass of the electron in terms of its energy, we get the wave packet's Group Velocity (Vg), which simplifies to the Velocity Equation.

- * $Vg = (h / L) (c^2 / h u) = c^2 / L u = c^2 / Vp$.
- * $(Vg) (Vp) = c^2$.

In the case of light propagating in a vacuum, both (Vg) and (Vp) have the value of (c). But in the case of light passing through a dispersive medium, or a klystron, or the electron, or any other particle of matter, the group velocity of the wave packet -- the

velocity of the packet's maximum amplitude, an illusion produced by the interference of the various superposed phase waves (Dw / Dk) -- is less than the speed of light. Therefore, there must be phase waves associated with the particle's wave packet, and these must move faster than light. Most physicists prefer to disregard the curious superluminal phase waves as irrelevant. However, I believe that this equation actually constitutes a precise definition of cosmic consciousness (cc).

The group wave represents the object of perception. The phase wave is the perceiver's consciousness. Multiplication of the two represents their interaction, the process of perception. One (c) is the retarded wave, and the other (c) is the advanced wave. The equation tells us that, when we detect the material particle (the so-called "observable" group wave packet), we tend to miss the superluminal phase waves associated with it. In cosmic consciousness we learn to appreciate the dynamics of the phase wave as well as the group wave.

In sections 4 and 5 of his lecture number 48, entitled "Beats", Richard Feynman discusses localized wave trains and probability amplitudes for particles. Here 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.