A Thought Experiment with Light:
How the ontological form of quantum mechanics is consequent to the principles of relativity theory

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Abstract: An imaginative exploration of space and time in which light mediates the relationship between finitude and the Infinite. Light becomes the creative source through which interiority and exteriority are manifested and brought into synchronicity as time, space and mass. The exploration probes the relational logic of relativity theory using the meta-physical insights of Augustine, Hegel, Levinas, and Peirce.

Keywords: Relational metaphysics, Light cone, Triadic logic, Semiotics, Complex Numbers

In the beginning

Imagine we are together in a spacecraft, far from earth or any other massive body. Suppose we take ourselves to be hurtling through space at a constant velocity. From what we see around us, how would we know we are travelling at a constant velocity? Perhaps the distant stars could serve as a guide. Like the stilling of waves into the horizon on the sea, the movement of the stars at ever increasing distance will be stilled into a spherical panorama. The "stilling" occurs because linear velocities are bounded by the speed of light while angular "distances" increase without bound. This enveloping, three-dimensional horizon will be like a fixed globe. Though it may revolve, the distant stars will maintain their relative positions or constellations to ever increasing accuracy the farther away they are. If we speed up or slow down, the globe *as a whole* will be altered because the Lorentz transformation will cause stellar aberration. The constellations will contort. So by careful attention to the horizon surrounding us, we can determine if we are accelerating linearly or travelling at fixed speed. Rotational motion will likewise manifest as rotation of the distant globe as a whole.

Now imagine that we are hurtling through space at twice the velocity as before. If our velocity is constant, how is this journey any different? Again the enveloping horizon will form a fixed globe, although the constellations may have a different contortion. The speed of light will be the same. Even if some nearby objects may move more or less quickly than before, these objects are random and particular, so what universal meaning would there be? Can it not be said that the two situations are identical? This is the principle of relativity. If we are only concerned with our spacecraft, it makes no sense to speak of "traveling at a constant velocity" or of "hurtling through space". In both and indeed all instances of non-acceleration, we are just sitting there watching the show.

Velocity is a relative concept and before we can speak of velocity, we need to identify an index or *origin* with respect to which velocity can be defined. The distant stars can tell us about

acceleration, but not about velocity. For the time being, we seem to be the only viable option for an origin. We remain at the centre of our coordination system and there is only our coordination system to speak of. And it makes no sense to talk about us as moving *through space*.

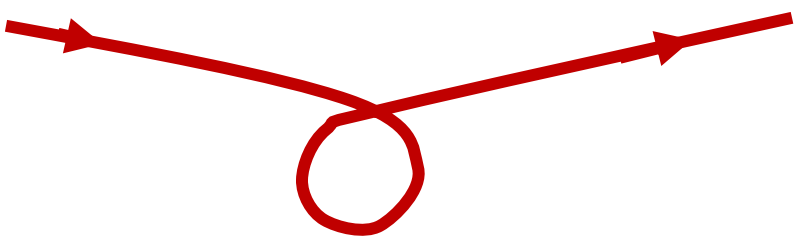
We need an origin before we can speak of time and space. And time and space will be specific to that origin. So what? Can't we just choose any old point in space and time to define an origin? Isn't that what we do when we create a frame-of-reference? But how are we to find such a point? Sure, when Newton's Absolute space and time ruled the day, there was an underlying framework such that any point could be an origin. But with relativity theory that framework is gone. Perhaps there aren't any "points" out there? After all, the point is really a Euclidean image and we know we are not exploring Euclidean space. If points are not out there, ready at hand as it were, for us to rest upon, what do we mean by an origin and how does relativity theory allow us to speak of such a thing?

Perhaps we should explore this a little further. What instantiates an origin as an origin for a frame-of-reference? With Newton's theory, was it not the earth itself which provided a stable reservoir of imaginative points at rest—a *geo*-metry? And wasn't his Absolute space an extended metaphor in which the vehicle was the fixed ground upon which we walk (inner space) and the tenor was so-called "outer space"? But here in our spacecraft the earth is far away and we are trying to explore the starry sky on its own terms, to the extent of our ability.

Let's return our attention to the distant horizon surrounding us in order to get our bearings. This globe does provide a reference for acceleration as we discussed earlier. But as for velocity, with respect to the horizon it is *undetermined*. Before, we might have taken that to mean that there was a whole set of possible frames-of-reference for an infinite set of possible constant velocities all of which were indistinguishable and one of which was selected. But now I am suggesting we only take this to mean that our velocity is not established by the horizon and perhaps it has no universal meaning. Nonetheless, there was a very interesting thing we noted about the horizon earlier. When *we* accelerated, *it* moved. This is a strange horizon indeed, because *it reflects back to us our own action*. Perhaps we ought to be careful, then, that we don't project ourselves onto the horizon and mistakenly assume something is happening *out there* when, in fact, it is happening *right here*.

Well, there we go again using Euclidean metaphors. The distant horizon is not "there" in a purely spatial sense, because as we look farther out into the horizon we are also looking further back in time. The horizon that envelopes us points *to the beginning*. The stars we see in our horizon are present to us as they were in the distant past when their light began its journey to us. And we are also present to other stars in the future as part of their distant horizon when our light reaches them. So there is a sweeping arc of light, as it were, from the beginning to our here-and-now and then back out to the ends of space and time. And all of this is present to us now—from the beginning to the end—although only partially and in reflection as we noted above. This is very different from the empty theatre of space which Newton invented to embed a universe. What should we call this arc if not the origin of our origin?

Figure 1: The arc of light



Horizon of "the beginning" → *Here-and-now* → *Towards "the end"*

Perhaps, then, there is a sense in which the dynamic of light sustains our presence here-and-now as an origin for a frame-of-reference. This dynamic brings us into relatedness with the horizon that surrounds us and that horizon points back to the beginning as original presence. The mediator of this relatedness is light.

Light as paradox

Light is what connects us to our horizon. Perhaps we might think of it as a sign of the absolute. For example, a second principle of relativity tells us that the speed of light is *invariant* in any frame-of-reference that is moving at constant velocity. Invariance or "without change" can be a signifier of universality, so light might also be a helpful guide to us in our journey. Notice, however, that we already seem to be muddled again in our metaphors because earlier we said that it may make no sense to talk about "moving at constant velocity" and, apparently, light is in agreement with this suggestion. Perhaps it is wiser to say that light, like the horizon, allows us to determine when we are accelerating and when we are not accelerating. Is it not as if light mediates for us inertia or "rest" as a ***special*** form of relationship with the Infinite?

We said earlier that light comes to us from distant stars and gives us information about how they were long ago. This way of speaking seems to make sense to us. But does it make sense to light? What I mean is that from the perspective of our spacecraft as an indexical reference, the statement has a particular meaning. But what might be said about the perspective of light itself? Undoubtedly we are entering into difficult territory here because the so-called "perspective of light" confronts us with an implicit infinity that is part of what we mean by saying that light is a sign of the absolute. To grapple with the theory of relativity is to grapple with the meaning of this encounter with "infinity". And we need to be careful that we don't assume this encounter will be formally the same as Euclidean geo-metry, since we know that the Euclidean formalism does not apply here. We also need to be careful that we don't project too much of ourselves onto "infinity" as we grapple with what is before us, although some projection is unavoidable.

So, please bear with me. Imagine, now, that we are travelling on a beam of light from a distant star to our spacecraft. How might we describe this? From our material existence, light is also a

horizon that cannot be reached—it is a horizon for the relative motion of two material objects with respect to one another. In order to imagine the "perspective of light", suppose we start by considering what happens as a second object moves towards us with a speed that approaches that of light. From our vantage, time will slow down for the other object and spatial intervals will contract in the direction of motion. In the limit that the speed of light is reached, there will be no passage of time and the spatial interval between the star and the spacecraft will become nil. So, what we might say from our vantage is that *for light* there is no space nor time interval in its journey from the star to the spacecraft. This comes from the principles of relativity theory. For light, the star and the spacecraft are in *immediate proximity*. But how can this be? How can it be that light brings the horizon of the stars—the beginning—into immediate proximity with us and yet we think of this horizon as far, far away? To continue with the thought experiment, suppose we reflect that light back out into space and it hits another star. Again there is no time nor space interval for the light. Let's call the first star A, the second star B, and our spacecraft C. From the "perspective of light" there is a way in which A=C – this we will call an identity because there is no time nor space interval for change. But from light's perspective it is also true that C=B. And yet, it would seem that A is not equal to B because they are different stars (or perhaps the same star in a different state if we reflect the light directly back on itself.)

At first blush, it appears that we may have encountered a contradiction. If two things are equal to a third, aren't they equal to one another? The contradiction may be partially resolved by recognizing that the third is actually not self-identical. In our thought experiment, an *action* occurred on the spacecraft in that the beam of light was reflected back. While this may allow us a temporary sigh of relief, the difficult problem of the proximity of light is not going to disappear. Here is why. If we return to our spacecraft, light is our only immediate guide to coordinate a frame-of-reference for our journey. But in trying to coordinate a frame-of-reference we must act and any action will mean that we are non-self-identical. There will be a gap, as it were, an indeterminacy surrounding our action that cannot be eliminated. *So we cannot use ourselves as a determinate origin.*

It may take some time to realize what a profound challenge this is. That's because we are so accustomed to assuming identity (of things or of ideas) as a foundation or ground for systems of states or knowledge. If nothing is self-identical then won't we be lost in an abyss of change? Isn't this what the deconstructionists are on about? All is relative, arbitrary and meaningless. Yet, in the theory of relativity, this is not the case –light comes to us as a sign of the absolute. To understand this sign, however, we may have to struggle with the primordial aspects of identity and difference.

Self emptying

Perhaps we ought to vigorously object to this way of thinking because we haven't defined what it is that is identical when we say A=C. Indeed, we are playing a bit of a trick here by trying to define identity almost like a verb before we define what the noun-things of identity are. But can we really ignore that there is a deep problem here? For example, imagine that we try to reduce the material objects (spacecraft and stars) to featureless points: A, B, C. If they are featureless, then identity means identical and not just identical in some way. However, light, which is our

sign of the absolute, does not appear to obey the laws of traditional binary logic. We appear to have the case that: A is identical to C and C is identical to B, but A is not identical to B. So perhaps we were right, there are no points out there and we would do well to dispense with this Euclidean image. But we also may be encountering a breakdown of the law of the excluded middle, because here C both *is and is not* C. In the discussion above, we introduced the concept of action to get as this "non-identical identity".

One approach open to us is to try to sort out this mess by careful attention to elements, definitions and the avoidance of contradiction. This is the approach usually taken in relativity theory. Here I propose we take a different approach. When we encounter contradiction, lets remain open to the possibility that this encounter is actually an encounter with the limits of our conceptual or logical framework. Such an encounter I will call a *paradox*. Whereas normal contradiction suggests we have made a logical error within our existing conceptual or logical framework, paradox suggests that our framework itself is inadequate and must be overcome. In other words, normal contradiction implies that we should correct or *fix* the way we are thinking, while paradox suggests that we should *unfix* the way we are thinking. Such "unfixing" involves identifying fixed *patterns of thinking* within the logical framework (that lead to paradox) and then relinquishing them. In this spirit, let's continue to explore how light might provide us with an identity operator in which non-identity is also implicit. What I mean by this is that we consider light to contain within itself the principles of both identity and non-identity (equality and in-equality). Also what I mean by this is that light obeys a threefold logic which transcends the binary logic that underwrites Euclidean geo-metry and differential calculus.

Another way to come at the impasse is to recognize that we are grappling here with the nature of "negation". Negation—including what we mean by "zero" or the "null operator"—is a tricky (non)concept because it lies between *finitude* and the absolute or *infinity*. The former is the domain of our world and our thoughts and is determinate. The latter is always beyond, transcendent and indeterminate. Negation, however, is between—partly determinate and partly indeterminate. It is "formless-form" or "formed-formlessness". Newton's Absolute space, and the calculus which underwrites it, is one approach to negation, the key to which lies in our experience of the earth as fixed space. Relativity theory brings forth a new approach to negation, the key to which lies in our interaction with light. And it is very important to bear in mind that negation carries with it—like traces or echoes—a priori categories or "prejudices" of the finitude from which is it derived. Negation is like "self emptying", which can bring into awareness the "ground" of the system, the "world", the "space" in which "self" is embedded (while at the same time pointing beyond the determinate limit of that space).

Relinquishing the Euclidean Point

Let's return our attention to the distant horizon that surrounds our spacecraft. Now imagine the spacecraft is rotating uniformly. The rotation will be apparent because the horizon will be seen to rotate about us as a whole. Rotation *differentiates* our spacecraft and the horizon bringing each into relationship with the other. A complete revolution brings us back to the *same* configuration of fixed stars in relation to our inner spacecraft. In this manner the *interior* of the spacecraft can be brought into synchronicity with the *exterior* horizon. The period of a complete revolution

marks a return to the same. This repeating cycle of Return creates a measure of temporality for our spacecraft as an origin. Because of the differentiation and return to the same that is inherent to circular motion, proper time might be said to be instantiated. Moreover, this proper time depends on, and in a sense belongs to, interiority. Let's call this instantiated temporality "Duration".

Rotation also creates two fixed points on the surrounding horizon which define the axis of rotation. As the spacecraft rotates, the distant stars trace circles. The closer a given star is to the fixed point, the smaller the diameter of the circle it traces. Conversely, stars found further from the fixed point trace larger circles. Following an angular arc from one fixed point (say above) to the opposite fixed point (say below) we can infer that there exists a plane perpendicular to the axis of rotation that acts as a divide, differentiating the upper hemisphere from the lower hemisphere. This plane *bifurcates* the horizon into two hemispherical domains each with its own fixed point.

What we are imagining here is a symmetry creating action—namely rotation—that differentiates interior and exterior and brings them into relatedness as temporality or Duration. This symmetry creating action further projects onto the horizon two fixed points and their domains of circular motion. The two fixed points can be joined by an imaginary axis of rotation which is *a line that cuts through the interior of our spacecraft as origin.* Transverse to the fixed points is a blurry plane of bifurcation that is not disambiguated.

Now imagine there is no spacecraft.

What I mean here is that we imagine removing the determinate aspects of the spacecraft in such a way that we are left only with the broken symmetry stripped of all extraneous trappings. The bare *re/action* which creates orientation about an origin. Let this origin become for us a new image that replaces the former image of a featureless point which dominates Euclidean geo-metry. Unlike a Euclidean point, the origin has interiority. It is *in*-formed. The determinate aspect of this in-formation is exactly reflected in the external horizon. Light, as it were, separates interior and exterior by bringing the distant horizon—the beginning of creation—to the inner horizon of the origin. At the risk of getting ahead of ourselves, might we not say that the origin is like a gap which rests on the edge of spacetime?

Similarly we might imagine harmonic motion as another form of re/action. Going back to our spacecraft, imagine we are vibrating uniformly along an axis. Vibration involves acceleration and so will be apparent by the changes we can observe in the horizon—stellar aberrations, for example. However, since vibration returns to itself regularly—like rotation—the changes will be cyclical. From observation of the stars, we can identify an axis of vibration and a smeared out or blurred plane transverse to the axis. This gives to our origin a sense of *extension* along the axis of vibration. Might it also be called mass? It is important to note that extension comes about because of a relationship between interior and exterior. It does not exist *in-itself*, but rather is a consequence of the relationship of the interior of our origin with the distant horizon. But the distant horizon is also in relationship with other origins. So extension, and mass, might be seen to be a consequence of the inter-relatedness of the ensemble of origins *as a whole*. But again I fear we are getting ahead of ourselves.

Return as the formal bearer of identity/difference

Light is the connector which brings interiority into determination and relation with exteriority. Light is creative in the sense that it allows the formation of an origin whose interior is related to the exterior.

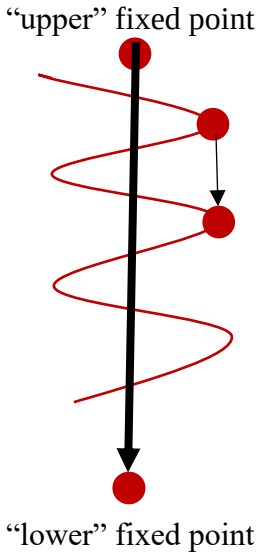
In our exploration of "origins" we identified two elementary processes or stationary modes. *Rotation*—which manifests duration and orientation—and *vibration*—which manifests extension (space). Now let's explore how these two stationary modes might be unified in light. We seek unification in light because we are taking light as a sign of the absolute.

To the extent that it might be possible, imagine again that we are travelling with a beam of light. Strap yourself down because this is wild ride that will horribly mix Euclidean and non-Euclidean metaphors with the hope that we come out with something helpful at the end.

Recall that when we explored the distant horizon with our spacecraft we identified two fixed points that defined an axis for rotation or vibration which cut through the interior of our spacecraft. If we now imagine we are travelling at the speed of light along this axis, the two fixed points will be merged together because the Lorentz contraction annihilates the distance between them. Additionally, light will compress spacetime into a two-dimension plane. That is to say, the beam of light will manifest the pure, unified form of the "fixed point" and of the "blurred plane" which we discovered in our exploration of rotation and vibration. If we were to image a simple collapse we would be left with quite a mess because there would be no capacity for differentiation of the plane. If, however, the light beam rotates around the axis of motion as it collapses spacetime, then a form of differentiation becomes possible. Let's call this "spin". This differential operator is quite different from the one invented by Newton because it does not pre-suppose identity. In other words it both differentiates and unifies at the same go. It is *creative*.

Bear with me here. Light is a proximity operator. From the perspective of light there is no passage of time nor separation of space. So light might be taken as an operator that brings origins into immediate contact. It gives them *sameness*. This is a global or universal operation. To get a handle on what we might mean by this, try to imagine the way light might compact or enfold the universe into a "blurred" plane. The transverse layers of the universe would be rolled up in a spiral along the axis of rotation for light as represented in Figure 2.

Figure 2: The Collapsing of Spacetime at the Speed of Light



As the spiral collapses, "origins" or domains parallel to the axis collapse onto each other. They are brought into immediate "proximity". In this sense they are identical. However, they are also differentiated because of the rotation of the light. There is a phase transition between the two instantiations of "origin".

If you are saying to yourself now that this is a crazy way to think about the situation I would be inclined to agree. How can there be any meaning to this construction where origins (and aren't we really talking about points anyway?) are said to be the same and yet different, collapsed and yet not collapsed? I would be inclined to agree, that is, if there were no precendent for this type of thinking. *But there is a precedent*. What I have drawn above is analogous to the plane of complex numbers.

And what I want to say is this: Whereas the ontological form of *discrete* objects is represent by natural numbers, and the ontological form of the space/time *continuum* is represented by real numbers, so light's *reflexive* ontological form is represented by complex numbers. In this way of thinking, we might see a problem with the Euclidean point as a metaphor. It accords with the ontology of natural numbers (that is, objects); whereas if we are to understand the role of light in relativity theory, we need to unpack the ontology represented by complex numbers, which unites and in a sense fulfills the discrete and continuous forms. And this will lead us to an understanding of the ontological form of quantum mechanics.

Synchronicity

Newtonian mechanics is contingent on a Euclidean form for space and time. A central metaphor in this framework is the "point", an ensemble of which becomes the featureless ground of objects and objectivity—the differential geo-metry of space and time. The differential operator, as an imaginary limiting form, becomes the passive, inert connector of points and, by extension, objects. This sets up for us a "self image" (point) and "world form" (spacetime geometry) against which we are trying to think in this exploration. In the Newtonian framework interiority, exteriority and their connector or mediation are all abstracted from a form of "nothingness". Yet this "nothingness" is a determinate, closed form—the empty vacuum. And, like the self image of the point, this totalizing form of nothingness is also assumed to be "given". Through our exploration of light we seem to have arrived at another possible metaphysical framework through which interiority, exteriority and their mediation are interwoven in an open and creative process. What is the nature of being or substance for this framework? What is the ontology of relativity theory?

Instead of starting with a self-same image, like the Euclidean point, we started our exploration by focusing on mediation—the connector between our horizon and our immediate presence. Light was identified as the bearer of this mediation or relation. Light creates symmetry by creating interiority and exteriority and bringing them into relation through an indexical origin. We identified "Return" as an original form. Through Return, identity and difference are brought into determination in and through their relatedness. The concept of phase, which is constitutional for complex numbers, provides a means to represent the form of Return.

In the previous section, we explored one stationary mode of return, namely spin (which is like rotation). As action, the "spin" of light is an original form of *in-formation* that brings into being time, identity, difference and orientation. The way it brings these into being is by allowing the formation of an *origin*. Unlike the Euclidean point, an origin has an indeterminate interior. In this simplest case, the indeterminate interior possess spin. This indeterminate interior exists in relation to its exterior which is both the bearer and the enabler of interiority.

Starting from the original form, the universe as it were, becomes populated with instantiated images of the original form. These images have extension (mass) which is a form of resonance with the horizon and with one another. Such images can become material origins for spatial and temporal coordination. A material or instantiated origin is borne by the distant horizon and comes into determination by synchronization with other origins. Light mediates this synchronicity of elemental in-formation by mediating response and counter response between instantiated origins as re/action couplets. Spin determines orientation and duration, both of which are local degrees of freedom which are limited/defined by the whole ensemble of origins.

The interiority of each instantiated origin is in immediate proximity with other origins *and* with the distant horizon through the mediation of connectors of light. This relatedness is a triadic logic involving the Same (*identity* or Firstness), the Other (*difference* or Secondness) and the horizon that enables and sustains Return (*reflexivity* or Thirdness). Triadic logic involves the exchange of in-formation through sign-bearing processes. The simplest example of a sign-bearing process is

spin. Sign-bearing processes bring the interior of each particular origin into an external and generalizing system of synchronization, such as a spatiotemporal system of coordination.

Reflection

Let's return to our spacecraft. Earlier we noted that there is a relationship between the action that occurs in the spacecraft and what we observe in the distant horizon. For example, when we rotate, the distant horizon rotates. When we vibrate, the distant horizon vibrates. The symmetry principle at work here is *reflection*. Our action is reflected in the distant horizon.

Reflection is the creative principle of extension.

Why do I say this? Let's again imagine ourselves travelling on a beam of light. As the light rotates and compresses spacetime, it brings "origins" (we are using this term in place of the loaded term "points") into proximity as schematically shown in Figure 2. Separation along the axis of rotation (which is also the axis of motion) is annihilated as we discussed earlier. Transverse to the axis of rotation we are left with a ring, or rather concentric rings, which fill the transverse, un-disambiguated plane.

But how does this play out for us in the spacecraft as the light overcomes us in moving from the upper hemispherical fixed point towards the lower hemispherical fixed point along the axis of motion that cuts through the centre of our spacecraft? While the vantage of light is a complex plane, from the vantage of the spacecraft light compresses space and time, moving from a distant past towards a distant future as represented in Figure 2. It is not just a spatial compression, it is a compression of space *and time*. Recall, the fixed point in the upper hemisphere belongs to the "horizon of the beginning", whereas once light overcomes us it moves into the future, towards "the end" as represented in Figure 1. For light, this slice of spacetime is all in immediate proximity. For us, in the spacecraft, the past is compressed into the future. It is important to note that the fixed point we see in the lower hemisphere is not the fixed point towards which light is actually travelling; the fixed point we can see from the spacecraft actually belongs to the past, to the horizon of the beginning, to the Origin and not to the future, to the end, to the Terminus.

So it is a bit misleading to think of light as compressing into a "plane" in the Euclidean sense, because there is an inherent, unexpressed orientation to the plane of light, an orientation that marks movement from the past towards the future, from the Origin (the beginning) towards the Terminus (the end). Unlike Euclidean geometry in which the Origin and the Terminus are identical, with relativistic spacetime the Origin and the Terminus remain differentiated, even in the Infinite limit. The plane of light cuts the past from the future *for us* at the same time that it orients us to "above" and "below" as different directions.

How is this process unified? What holds together the differentiated Origin and Terminus? What is the principle of identity at work here?

From the vantage of our spacecraft, we considered light travelling from the upper hemisphere into the lower hemisphere. Yet, we might equally well have considered light travelling from the

lower hemisphere to the upper hemisphere. These two possibilities reflect one another and create a binary dialectic of orientation along the axis of motion of light, an orientation that is either upwards or its reflected image of downwards depending on which of the two possibilities is at play.

Now try to image again that there is no spacecraft.

What are we left with? Are we not left with a pure dialectic of orientation along an axis of motion? The unification of the Origin and the Terminus—a unification in the Infinite "distant horizon"—enables and sustains the instantiation of a un-disambiguated binary dialectic (up or down) along a particular axis while at the same time blurring the transverse plane because that plane lacks orientation (it has no orientation operator). This *interior* dialectic is contained as an instantiated domain, an indexical origin for a coordination system. *And this indexical origin is an image of the Infinite horizon.* The likeness of image and prototype is found in the binary logic of opposition, a logic that is only potential until it becomes expressed in a particular instantiation, a particular image.

Resonance and extension

Let's try to get a handle on how the image might become instantiated.

Recall that a beam of light coming from the upper hemisphere is compressed into a complex plane oriented in such a way as to differentiate upper and lower. As the light rotates and compresses spacetime, separation along the axis of rotation (which is also the axis of motion) is annihilated as we discussed earlier and represented by Figure 2. Transverse to the axis of rotation we are left with a ring, or rather concentric rings, which fill the transverse, un-disambiguated plane.

Let's consider one such ring. The ring will form an enclosure about the axis of rotation which creates a separation between the interior and the exterior for the transverse plane. The "interior" is the circular domain containing the axis of rotation and the "exterior" is the open domain formed by the transverse plane with a "hole" cut out of its centre. (Perhaps we should say a "w/hole"?) The ring represents a single period of rotation for the light which we called the "spin".

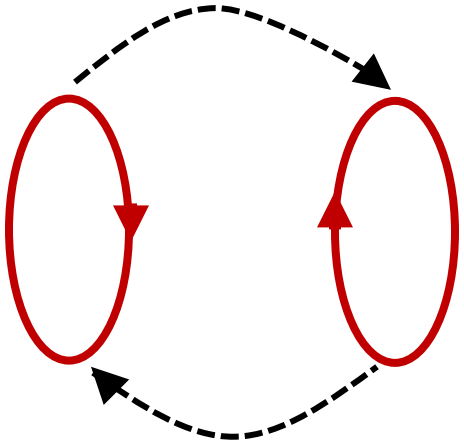
But the beam of light can rotate multiple, and indeed an infinite number of times about its axis. So the single ring also represents multiple rings (a consequence of the "collapsing" of spacetime into a two dimensional complex plane as represented in Figure 2.) Let's take this to mean that a single ring can be *in proximity with* any number of other rings of the same "diameter" and centred around the same axis of rotation. This relationship of proximity we will call an *identity*.

A similar compression would happen for a beam of light travelling in the opposite direction, from the lower hemisphere to the upper hemisphere.

These two complex planes can be synchronized *through reflection*.

Consider two rings of the same diameter in reflective proximity with one another, one from the upper plane and one from the lower plane. Each rotates with same period T which is the fundamental temporal operator and is determined by the spin of light. *The relationship of proximity will bring the two rings into synchronicity*. Might we not represent this in the following way? A single revolution around the first ring is followed by a jump to the second ring. Then there is one complete revolution around the second ring followed by a jump that returns to the first ring.

Figure 3: Creation of a Finite Domain by Light

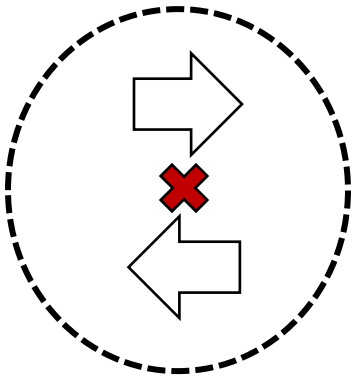


Rings—as boundaries for open domains—resonate between two reflected planes of light with opposite orientations.

Note that *three* processes of Return are involved here: the revolution about the first ring, the revolution about the second ring, and the jump return between the first ring and the second ring and back again. The last revolution is actually bifurcated into two symmetric jumps. If we were to synchronize this bifurcated process with the original beam of light, might we conclude that the period of this double movement is twice the period of the light beam, or that the double movement has spin ½?

Might we also conclude that it has the topological form of a "spinor" in the sense that two rotations are required before there is a return to the "same"?

Figure 4: Reflection as the creative principle of extension

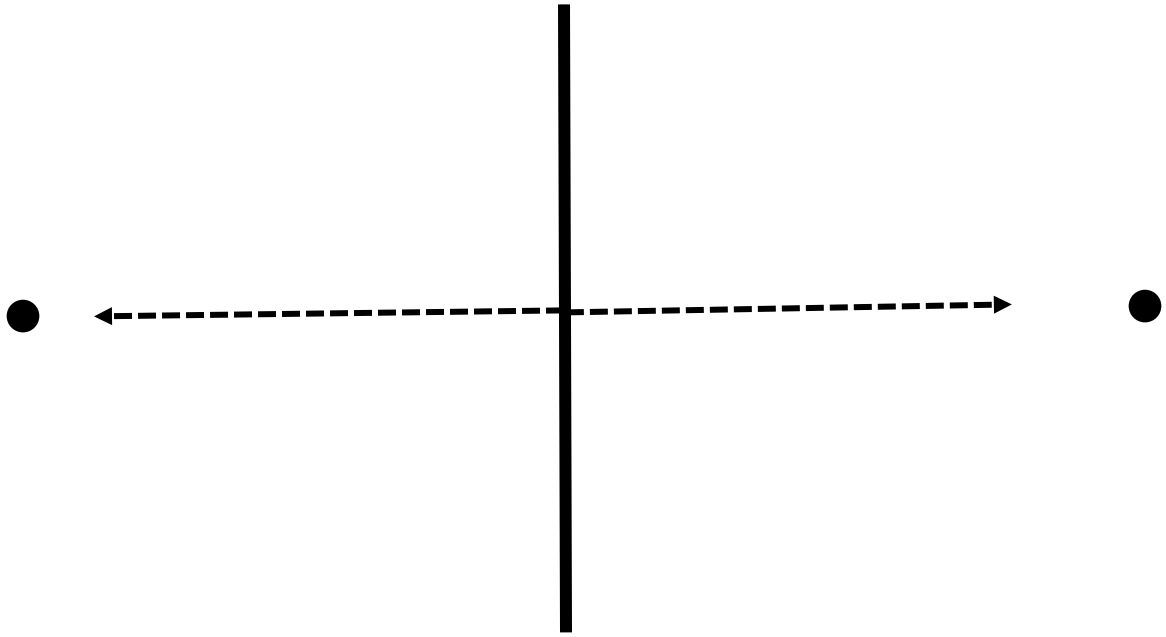


The process I am trying to describe here involves the "holding together" of an open domain by the Infinite horizon of light. It is a particular form of relationality by which an image of the Infinite is instantiated and endures as an origin of rest or inertia. However, unlike the featureless Euclidean point, this domain of rest, this indexical origin, has interiority in the form of un-disambiguated binary opposition or resonance.

Recap

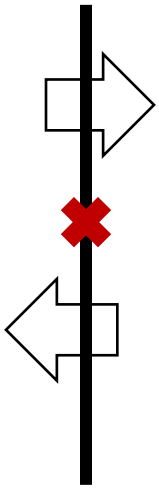
Let's return to the vantage of our spacecraft, which I will now call the "outer world view". In our exploration, first we considered rotation in the outer world view. We identified two fixed points on the horizon which were related to the axis of rotation. We identified concentric circles around each of these fixed points about which the stars revolved and a transverse plane that bifurcated the horizon into two domains, one for each fixed point, such that each side of the transverse plane "pointed" to a different fixed point. Before we thought of these fixed points as "upper" and "lower", but now lets just represent them as "left" and "right" because in the course of our thought experiment we have brought them into an equality.

Figure 5: Outer World View



Second, we considered the mediating form of light through which the two fixed points were merged and spacetime collapsed into a two dimensional plane.

Figure 6: Mediating Plane of Light

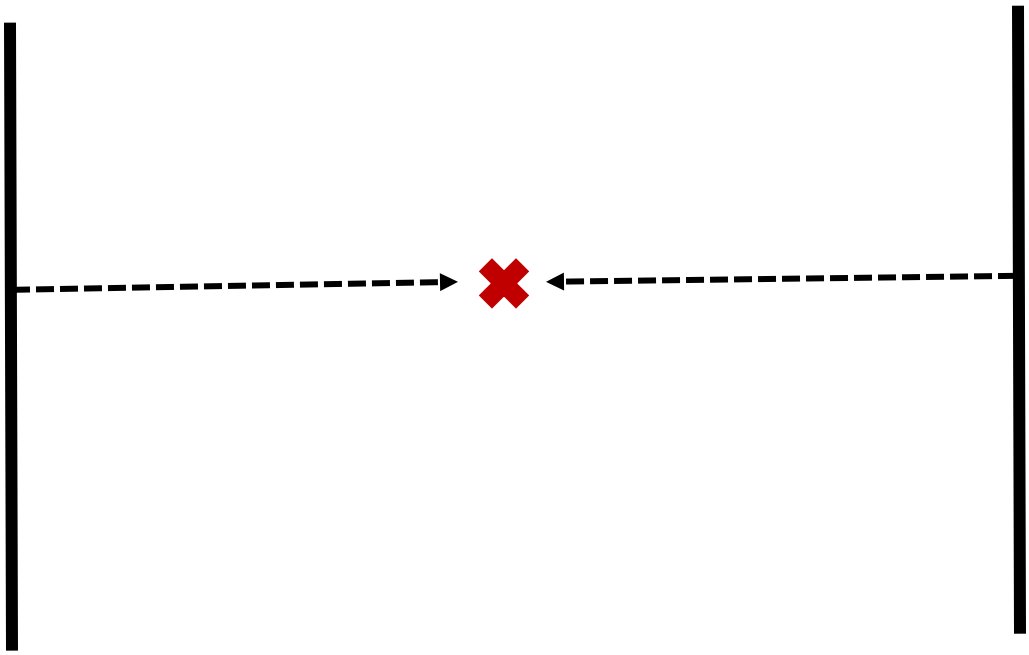


From the vantage of light, the collapse has the form of a complex plane as represented in Figure 2. The two external fixed points at infinity (the "beginning" and the "end" in Figure 1) are brought into proximity at the origin of the complex plane. *Yet they remain distinct*. The distinctness of the two fixed points is the genesis of asymmetric temporality (duration) which allows us to speak of the "motion" of light as motion from … towards …

From the vantage of our spaceship, there are two possible ways spacetime might collapse into a complex plane of light. Light might travel from the upper (now "left") fixed point to the lower (now "right") fixed point, collapsing the four dimensional spacetime into a complex plane oriented to the right. Or light might travel from the right fixed point to the left fixed point, collapsing spacetime into a complex plane oriented to the left. In this sense the complex plane is different from a normal Euclidean plane because it possesses the potential for disambiguation—the creative operation of orienting. The Origin of the complex plane is not a Euclidean point. It possesses within itself an inherent, unexpressed symmetry principle that only becomes expressed when the complex plane is disambiguated into a four dimensional spacetime manifold. This inherent, unexpressed symmetry is the *orientation* of the travelling beam of light. It is the orientation of the axis that connects the left fixed point with the right fixed point. Orientation belongs to the interior perspective, the perspective of our spacecraft. Light has within itself the creative principle of orientational symmetry, but orientational symmetry must be disambiguated by the interior domain of our spacecraft in order to be *realized*.

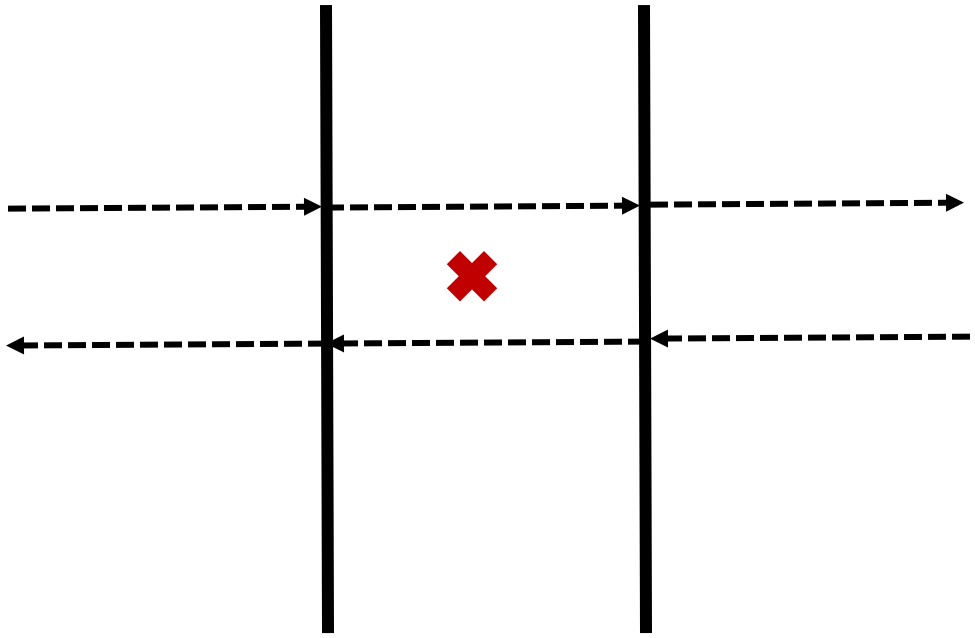
Third, through reflection, we arrived at an “inner world view”—the image of the Infinite—in which there is one fixed point at the origin (a reflection of the distant horizon) and two transverse planes pointing towards one another.

Figure 7: Inner World View (Image)



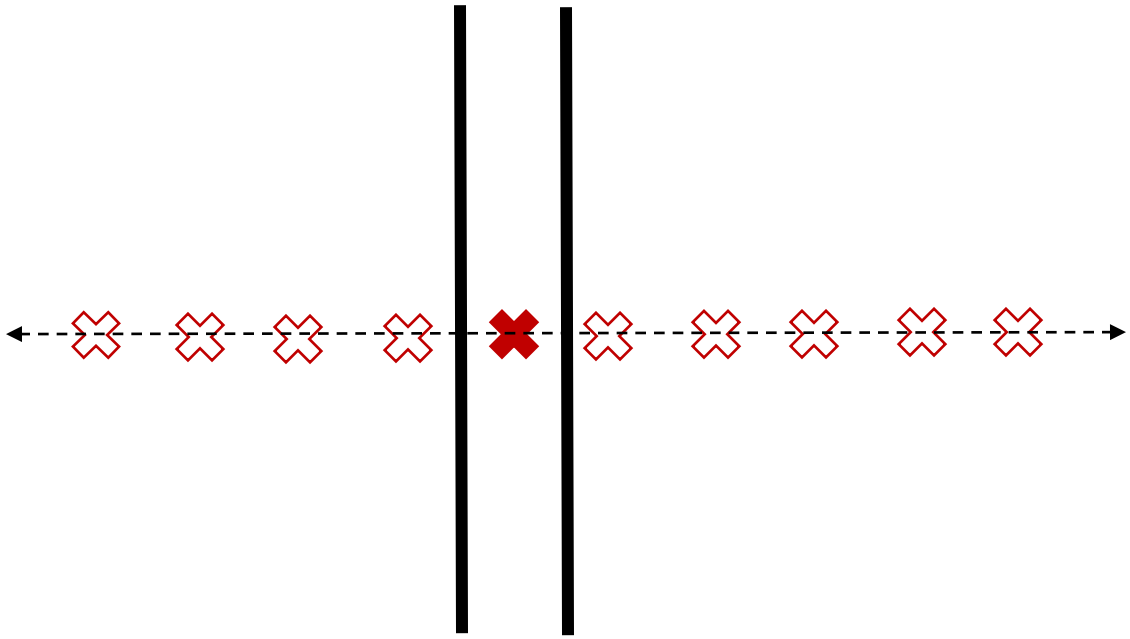
Finally, however, the Outer World View and the Inner World View can be synchronized by the Mediating Plane of Light. This will result in a “standing wave” in which two planes of light are oriented in opposite directions

Figure 9: Synchronized Reflection



However, the situation is quite different than the way we normally think about standing waves, because here *it is the origin that causes the wave to interfere with itself*. This "self-interference" comes about because of the doubling nature of reflection and it causes an outward radiation of fixed points. In this way might we say that extension is synchronized? Would not the separation of the fixed points be determined by the radius of the "rings" and might we not connect this with the notion of mass?

Figure 10: Instantiated origin for the coordination of space and time



Generality

Our thought experiment seems to lead us to the following conclusion. Through a process of synchronization, reflection interiorizes the distant horizon as an origin. The origin is a spinor or fermion which is both a doubling and an inward enfolding of light. This origin is creative, resulting in the outward propagation of equidistant fixed points which represent images of the localized reflection process. In a sense, then, light results in the *creation of spatial extension.* This symmetry creating process involves spin about an axis of orientation that is synchronized with resonant linear reflection or vibration along this axis. The instantiated origin might be said to have a (rest) mass which is related to the period of vibration or resonance. This period of vibration might also be taken as indicative of the local or proper time. But it is also important to recognized that we are not speaking here of determinate rotation and vibration within some externally defined measure of space and time. We are speaking about the *limits of determination* that sustain any origin as an indexical origin for coordination of space and time. This limit of determination comes from the spin of light as mediator of synchronicity.

Having imaginatively instantiated an origin, we are now poised to consider the coordination of space and time. Such a coordination process will involve the mutual interactions of two or more origins through the mediation of light. One way to think of this is to take each origin to have interior degrees of freedom (related to orientation and displacement) which only come into determination through the resonant relationship it has with other origins. So the degrees of freedom for a differentiated origin are determined by its relationship to other differentiated origins. Light mediates this inter-relatedness of action and re-action.

However, there is no such thing as an origin-in-itself. An origin, as a differentiated origin for the coordination of space and time, exists in relationship to other origins of differentiation. The individuality of a specific origin—to the extent that it can be individual at all—comes from the dyadic relatedness of this indexical origin with "others" of the same. This dyadic relatedness, in turn, depends on the mediation of light, not only among dyads, but also with the "origin of origins"—what we have been calling the "distant horizon". This latter mediation establishes the interpretive framework or *world* in which origins are created. The mediation of light establishes *the ensemble of origins as an interpretive system.* A particular origin is embedded in a generalizing system through the triadic logic of relational meta-physics.

In our simple thought experiment, we have imagined the instantiation of an origin for the coordination of space and time. This origin only exists in relation to other origins and coordination only happens by virtue of the inter-relatedness of origins. Let's consider the interaction between two such origins represented graphically below:

Figure 11: Coordination of multiple images of the origin

Each origin has a repeating resonant structure which is the manifestation of the symmetry of reflection. What is important to note is that there are two different ways in which these origins might then synchronize the "distance" between them through the proximity of light. Each way might be called an "interpretative framework" for synchronization.

1. A standing wave might be established between them such that there remain a fixed number of nodes separating them. This is an external synchronization of the fixed space between them. It will result in a discrete measure of that space since there is no way to differentiate the in-between of the nodes. Such a measure is often called wavelength.
2. Their interior phases might be brought into synchronicity such that they continuously differentiate one from the other. This is an internal synchronization of time. It will result in a continuous measure of relative momentum.

By bringing a third origin into the description, it might then be possible to look at the way in which these two interpretative frameworks are inter-related. First, let's consider the third origin to be another instantiated origin like the other two. Beginning with our indexical origin we can establish a standing wave pattern with the second origin which can serve as the calibration of spatial extension. Between the second and third origins there will be the creation/annihilation of spatial nodes which can be measured by using the calibration relationship. Alternatively the phases of the indexical and second origin can be synchronized such that the continuous differentiation of the third in relation to them can be measured. The first method will establish a measure of spatiality as exterior synchronization and the second method will establish a measure of momentum as interior synchronization. But can these two frameworks be united? How would we do this if not by considering one of the three origins to be the distant horizon? And if we try to do this, won't we find that the commensurability of the two interpretative frameworks will remain perpetually frustrated because the distant horizon is open and creative, rather than closed and deterministic. In other words, the uncertainty that exists in trying to harmonize the two frameworks—namely the Heisenberg uncertainty—is indicative of the essence of light as creative and open. *Principia Mathematica* reveals for us the limits of our finitude.

Mass and gravity

In the final movement of this étude, let's imagine a very massive body in the universe, say like the Sun. By massive we mean that the body consists of a large number of origins (open domains or images) that are highly synchronized with one another and with the distant horizon. There is such an overwhelming exchange of light between the open domains constituting the body and with the horizon that a spatio-temporal field of coordination is created for this body which we are taking as an index. *The body forms a system.*

Or, to flip this way of thinking around, lets define "very massive" to mean that space and time are highly coordinated in the neighborhood of the body as an index. Because space and time are highly coordinated, we don't have to concern ourselves as much with the fine details that are consequent from the "blurriness" of extension, neither in space nor in time. Additionally we are considering an index that synchronizes in three-dimensions, rather than the single dimension described above.

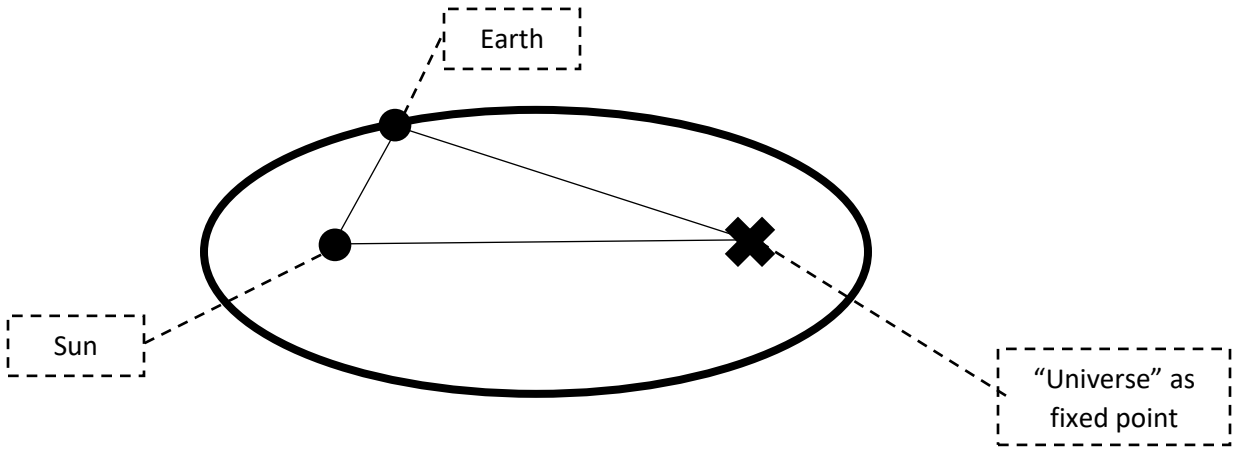
Let's also imagine a second very massive body with similar properties, say like the Earth. Now we ask the question: how do the two massive bodies become coordinated relative to one another? This question is concerned with a *three-fold* relationship involving the Sun, the Earth and the Distant Horizon.

Perhaps you feel this thought experiment is illegitimate because we are speaking about "highly correlated" as if we knew what that meant, when spatio-temporal coordination is really the core problematic of this exploration. Such skepticism is quite appropriate. I can only ask that you bear with me again as we park this concern for future consideraion.

Suppose we take the Sun to be very massive, even in relationship to the Earth. Then, the Sun and the Distant Horizon will be coordinated through the exchange of light. Let's take this relationship as our indexical relation. The Earth will be brought into relationship by a double exchange of light, both with the Sun and with the Horizon. In this way we might begin to see that the core relationship in this model universe is the Sun as same, the Earth as Other and the Distant Horizon as Universal third party. The mediator of the relationship is light.

The synchronicity of light now manifests as a cycle of return from the Sun to the Earth to the Distant Horizon and back to the Sun. This cycle is an invariant. The situation we are describing might be represented by an ellipse where the Sun is one focal point and the Distant Horizon or "Universe" is the other focal point.

Figure 12: A mean field model of the solar system



The key property here of the ellipse is that the path of return from one focal point to a point on the ellipse to the second focal point and back is a constant. The fixed distance between the foci establishes the indexical relationship of spatial separation or *extension* and the return path of

light establishes a corresponding measurable temporality or *duration*. The elliptical movement of the Earth becomes its determined degree of freedom.

And so we have arrived at Kepler's orbit. But perhaps with a new perspective. The orbit is not embedded in Newtonian's Absolute space and time. Rather it is the relationship between the Sun and the rest of the universe (the Distant Horizon), through the exchange of light, which establishes a spatio-temporal coordination system *for the motion of the Earth*. We have approximated this by representing the "Universe" as a ghost image of the Sun at the other focal point of the ellipse. This, of course, is an approximation. But what is interesting is that the orbit is actually a many body system involving an index (the same, Sun), an other (the Earth) and the whole (the universe of all stars). And the dynamics of this many body system is mediated by the proximity of light. And to the extent that we imagine the universal fixed point as "nothingness", we return to the closed, lifeless mechanical model of Newton.

Parting words

I hope you have enjoyed this imaginative journey through math and metaphor. I'd like to leave you with some parting words which might perhaps trace our exploration together:

blue water stilled
in the precise horizon of another blue;

dance of broken light

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