

The Paradox of Physics

Philip Franses Philip@schumachercollege.org.uk

Abstract

When you come to look into the nature of the world it is full of paradoxical questions. It was the inventiveness of the twentieth century to take some of these paradoxes seriously. Thus Einstein built relativity on the understanding that travelling at the speed of light one would register no interval of space or time. Or Bohr argued quantum theory from the tested fact that where an observer makes a measurement is able to change the outcome of an experiment.

The old wisdom would say that the relation of the spiritual to the material is itself an unfathomable paradox. Yet our scientific caution still demands that we only accept the paradoxical as it applies to material grounded existence. What if we allowed that many of the paradoxes of life are to do with making choices about a meaning we dimly perceive that only becomes real in the living?

A system of paradoxical logic (Spencer Brown, Kauffman) allows a broader foundation than classical physics. But here a new paradox emerges. If we enlarge the ground of events for physics to consider, then what we mean by space and time radically changes. So how does the time of paradoxical logic compare with the time of the logic of existence, in which things already are?

Here we are confronted with a new paradox on which to apply our logic of paradox.

“If my being is paradoxical, then what is meant by that paradox?”

Is our logic of paradox able to resolve this existential dilemma?

Paradox in space

If we want to find evidence for the logic of the paradoxical in physics, then we have no further to look than three-dimensional space.

Let us start with the observation of the world as occupying a three-dimensional space. Dimensions have a paradoxical relation to each other. Breadth, depth and height are independent while related. They flow through each other yet remain themselves.

We are able to both analyse the world as height, breadth, depth, as to put these together and interpret an object, say a house as a unity of extension.

Lou Kauffman goes into great mathematical detail about the nature of three-dimensional space (Kauffman, p.125-138). Our mind sees by establishing planes of reflection in between that partition the object in terms of breadth, depth and height. Our mind is doing something active, finding planes of reflection that identify the object in its three dimensional world.

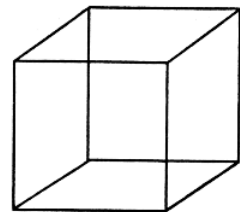
This trick of reflection works, because the dimensions are symmetric with each other. The plan of reflection sees something behind and something in the fore of what then appears to be a dimension of depth. One seems to be seeing into the object as something with perspective. But the trick of reflection locates the origin of the 3D-ness in the object itself. The chunkiness is understood from the perspective of being an attribute of the object itself, not the seeing. The process of seeing reflects the front to the back, the left to the right, the up with the down, to leave an appearance of a substantive occupation of 3D space.

Each dimension of breadth, depth, height are interchangeably symmetric. One could in fact (at least mathematically though not visually) have any number of independent dimensions and the trick of reflection would switch between a feeling of separate aspects of extension and a feeling of a whole thing occupying space.

The paradoxical nature of this seeing is illustrated in many ways. For instance if one focuses first on a house in the foreground, then one sees in it depth etc. If one then focuses on the forest beyond, then the house becomes flat in its disregarded irrelevance to the scene of one's attention.

One can also poignantly see this reality in the reversing cube. The mind can invent different planes of reflection to create a cube out a flat two dimensional image. One continually sees between the two different 3D interpretations.

Figure 1: Reversing cube: there is an ambiguity in how the mind turns this two dimensional object into a three dimensional form. One can indeed feel the cube flipping from one state to the other.



The first state the cube is sitting comfortably between this text and the text above. The vital plane of reflection we use to construct the cube is located upon the 2D surface of the page.

In the second rendition, the back face of this cube going into the page becomes the outward pointing face of a cube whose dimension is through the page. The plane of reflection is situated between the page and us.

The reversing cube again illustrates how the logic of 3D seeing is paradoxical. The same lines on the two dimensional page of breadth and height can be turned into different 3D representations. The mind reflects the lines into different objects. The three dimensional sense is realised by a process of utilizing planes of reflection, which can be employed to realise different results.

The utility of the paradoxical is unquestionable. We enter into a three dimensional view, that holds the object of our attention, to allow our mind to journey through the detail, of windows, roofs, drain etc singularly, while allowing at any time that the paradoxical dissolves back into the unity of a house. There are many ways we can represent the house through planes of reflection. But the reflection gives to our attention a structured facility to "go into the house" and to focus on the specific detail of its parts. The paradoxical mediates our linear analysis with the oneness of the object.

Also the paradoxical is no less logical for not being exact. Planes of reflection augment the linear aspect of mind, to concentrate upon a particular detail, by sorting the information of our seeing into different simultaneous dimensions to detail. The depth is created by the symmetry of front-back, left-right, up-down that allows us to contrast and distinguish a pattern of symmetry. The planes of reflection we use allow us to tell a house by the pattern of contrast between back and front, up and down, left and right. At the same time these symmetries can be used to separate the house into dimensions locating the aspects of detail, such as a window, we in turn might wish to examine.

The paradoxical gives to our mind the transparency to explore the world before deciding on its pattern. Our seeing is fluid to invent its own reference in which to manipulate the world without thereby changing what we see. The paradoxical allows us to move to the real in the way we want.

Paradox of here

When Grandy writes about light he points out that a tree that is several hundred metres away through the window is brought by light into the awareness of hereness. Light brings about presence from things that are in fact distant from me.

“By means of light mediated experiences, we are able to have visual experience of things not materially present. As a presenting medium, however, light does not yield to such experience. To bring off vision of other things, light must be the “letting appear” that does not itself appear. It must also be the “letting appear” that gives rise to visual experience not spatially and temporally coincidental with the things experienced. In letting all this appear or happen, light is not party to any of it. Its lack of appearance, its clearness, or invisibility, keeps it fully present, rather than imaginistically divided off into places we call ‘there’ and ‘then’”. (Grandy, p.56-57)

We can try this out by looking at something far off that light makes appear as here, present to us. It was this understanding that Einstein used when coming to his theory of relativity, that for someone travelling on a beam of light, they would experience no separation, or duration. For light is the bringing of presence, by definition. Light experiences no interval of passage in itself. All finite passages have to be weighed in relation to light.

We build up a picture of the world by here’s and now’s created by the act of establishing presence through the exercise of light. What light makes present is the relative perspective from which our experience finds its place as a manifestation of a here and now.

Paradox of now

In Maxwell’s equations demonstrating the existence of electromagnetic waves, there are two solutions. In one, the wave moves with a particular (retarded) speed around 300,000 km/sec. In a second solution, the wave appears to travel ahead of time. This is known as an advanced wave.

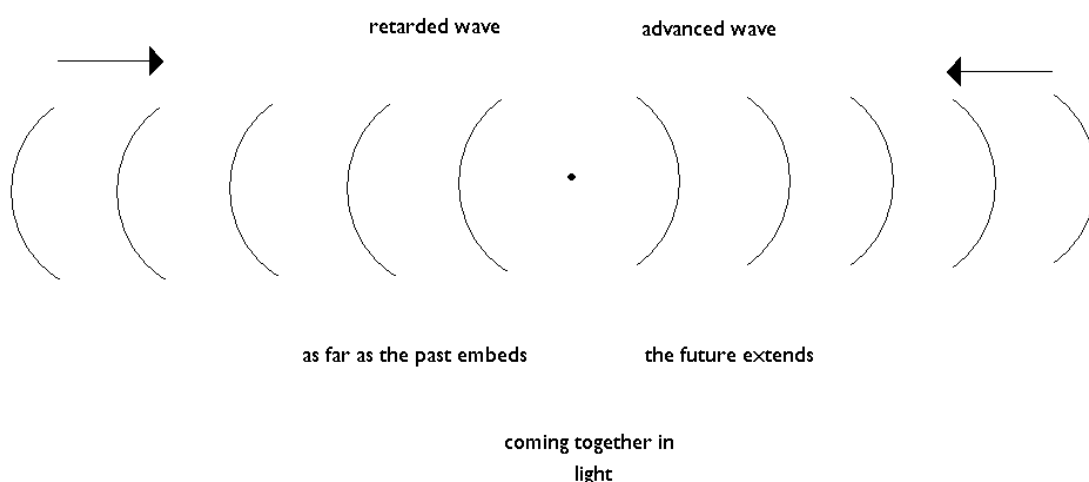


Figure 2 Retarded and advanced wave

The first solution states that as we look back to the past, the wave lags behind time by an increasing amount, indicating the finite speed the wave needs for passage. This wave is drawn on the left hand

side, giving a necessary causal foundation (or root) to the future that light is also able to support. The second solution increasingly speeds ahead of where time has reached! This is the wave on the left that anticipates the course of time in a behaviour that bends the future in readiness to receive and resolve the delay of the wave out of the past.

Everyone is familiar with retarded waves – when one throws a stone into a pond, the wave does not spread instantaneously throughout the whole pond. The wave moves in concentric circles at a finite speed through the medium of the water. The wave is retarded. Inward moving waves, in contrast to the outward moving waves of a stone in a pond, are known as *advanced* waves in that they exist before the disturbance that is responsible for them. The *advanced* wave plays the movie backwards, so that the concentric rings move inward up to the point figuratively of the stone lifting out of the water.

‘Maxwell's theory of electromagnetism, developed in the mid-nineteenth century, is easily seen to admit two kinds of mathematical solutions for the equations describing radiation of energy in the electromagnetic field.

One sort of radiation, called the retarded solution, seems to correspond to what we actually observe in nature, which is outgoing concentric waves. The other case, the so-called *advanced* solution, describes the temporal inverse phenomenon - incoming concentric waves - which never seems to be found in nature. Thus the puzzle of temporal asymmetry here takes a particularly sharp form. Maxwell's theory clearly permits both kinds of solution, but nature appears to choose only one.’ (Price)

Feynman and Wheeler (1945) first suggested that we see the advanced and retarded waves as part of a single phenomenon. In Feynman's Nobel-prize acceptance speech he recalls,

“Let us suppose that the return action by the charges in the absorber reaches the source by advanced waves as well as by the ordinary retarded waves of reflected light; so that the law of interaction acts backward in time, as well as forward in time. I was enough of a physicist at that time not to say, "Oh, no, how could that be?" For today all physicists know from studying Einstein and Bohr, that sometimes an idea which looks completely paradoxical at first, if analyzed to completion in all detail and in experimental situations, may, in fact, not be paradoxical. I found that you get the right answer if you use half-advanced and half-retarded as the field generated by each charge. That is, one is to use the solution of Maxwell's equation which is symmetrical in time.’ (Feynman)

We can also understand past and future in symmetrical juxtaposition, as a way of focusing our seeing upon the experience of now. Light brings into our now, a future sense of how a past left open, may be completed.

The future delivers its own personality of character as alone capable of stating this present. Instead of defining the observer beforehand as fixture of the reality to be explored, the observer is left open as a freedom to be resolved in the event giving meaning to its relation to the observed. Similarly instead of the observed being an objective truth already out there waiting to be passively seen, the material universe of objectivity is similarly to be a freedom seeking expression in the meeting with the observer.

Advanced and retarded half-waves are a symmetry of division as space, in which future and past can reflect a whole instance of temporal unfolding. The separation of time, in moments held distinct by clock hand differences, turns into the balance of time, to hold a concentrated moment in its own inward sense of itself. Time lives in the leap by which what scratched at the glass of reality inadmissibly, is suddenly freed into a noticing of eternal license.

Paradox of paradoxes?

The question we are asking then is can we turn this paradoxical attitude of seeing on itself. We can then filter the world through its own innate unknowingness until meeting that quality of expression that tells us uniquely as interpreters of meaning. Thus we turn the paradox of the filter of seeing into the question of our seeing itself. The filter of the paradoxical by which the world is differentiated turns into the question of our own finite meaning as aware subjects. Paradoxical logic is given the freedom to come to its own meaning.

Advanced and retarded waves, the observer and the observed, the wave function and its conjugate, are not alternative representations of existence where the one follows the other. They are all together a statement about a moment, in which the tension of opposites is held in an overcoming. So Kauffman describes a matrix of advanced and retarded waves, in which the composite sense of both realities carry their paradoxical tension in a mathematical form of their unified action. The world is able to make meaning without untangling into exact fragments the contribution of prophetic intuition and historic analysis.

We already thus possess a different mathematical approach to physics, that describes dialogue between observer and observed, feminine and masculine, future and past without having to intercept these elements in their separate articulations. Instead of putting physical concepts in boxes – mass belongs to the observed realm; awareness to the observer (human) realm; etc there are acts of meaning generating their own order. The multiple dimensions of paradox, allow an order at many levels of existence. We are no longer required by paradoxical logic to untangle these layers of meaning from each other into separate disciplines.

The very quality of dialogue is for two opposing tendencies to come together in unity that is more than either part. The boxes removed, the paradoxical is no longer the oddity of physics, but the very heart of existence that gives the world its many sided nature.

This type of order is enabled by the inclination to wholly commit to the admittance of a disruptive element into existence. In personal life, this means to accept moments of complete inner upheaval to make way for what demands recognition in the new expression of meaning.

The mathematics that describes jumps between discrete states of reality, allows for existence to leap in and out of its own skin altogether. The gathering of unity, behind the scenes, makes the case for existence to decide upon its own intrinsic paradox. The basic question lets us swing in and out of existence, until our stumbling shall reveal the secret of the finite box of the world in which we are. The paradox in and out of existence, adds up to the saying of the nature of the finiteness of what contains us in relation to the infinite.

The question where existence is faced with its contrary opposite, allows that leap of the unexpected to deliver out of nowhere the seeing of the finite situation. The paradox of physics focuses separate individuals upon the dilemma of creation or destruction, to be seen from beyond our own sphere of knowledge.

Existence decides between creation and destruction, to the demonstration of a higher witness.

Bibliography

Feynman, J. (1965) The Development of the Space-Time View of Quantum Electrodynamics; Nobel Lecture, December 11 (http://www.nobelprize.org/nobel_prizes/physics/laureates/1965/feynman-lecture.html retrieved on May 9th 2013)

Grandy, D. (2009) The Speed of Light; constancy and cosmos; Indiana University Press

Kauffman, K.L (1982) Sign and Space; Religious Experience and Scientific Paradigms, Proc, of the IASWR conf. Institute Advance Studies, Stony Brook New York, p.118-164

Price, H. (1996) Time's Arrow and Archimedes' Point; Oxford University Press

Spencer-Brown, G. (1969) Laws of Form; Allen and Unwin, London

Wheeler, J. A.; Feynman, R. P. (1945). "Interaction with the Absorber as the Mechanism of Radiation". *Reviews of Modern Physics* **17** (2–3): 157–161. Bibcode:1945RvMP...17..157W. doi:10.1103/RevModPhys.17.157.