

Essay

Images, Mathematics & Consciousness

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Abstract

In this essay, I discuss structural relation among concepts (images) that creates the sense of physical reality we experience in everyday life. As an example, I describe the connection between the image of cardioids on the mosaic in Isfahan Mosque, Iran, and the formula for cardioids discovered by Europeans much later.

Keywords: Art, image, science, mathematics, concept, consciousness.

Science may not give us a complete picture of life because it does not deal with experience beyond its own realm of study. Many scientists admit that there is no way to understand subjective phenomena in any scientific manner. What we actually experience within our own consciousness will never be experienced by others in any objective manner, remaining permanently beyond the bounds of science. Scientists try very hard, in fact, to keep the scope of their inquiry clear of subjective phenomena in order to avoid the taint of opinion or prejudice.

What do we do, then, with the very real yet untestable part of reality to which we cannot point? Must we admit that there is one reality for what “we” see, and another for what “I” see? Are we forced to conclude that there are separate and distinct realities that meet only at the surface between brain and mind? From a philosophical, theological, or psychological standpoint, this is entirely unsatisfactory. But it is just what we have been doing for the last three and a half centuries.

Within the last century it has become unsatisfactory from the scientific point of view as well. In physics, there is no longer a strict separation between subjective and objective. In each of the enigmas mentioned in the introduction and discussed later in this book, the “role of the observer” must be taken into account in order to understand the physics involved. In relativity theory for instance, an observer sees a rapidly moving object become shorter, gain in mass, and move through time more slowly only because his “frame of reference” is moving relative to the object. An observer moving with the object (in the same frame of reference) does not experience these dilations in space, time, and mass. In quantum mechanics, it is the act of observation itself that determines the outcome of an experiment. Extremely small particles pop into existence at indeterminate locations in space and time only when they are observed; where they are (or if they are) in between observations cannot be determined. In modern physics things do not just happen in an empty, dead universe—there has to be somebody, or something, observing an event for it to

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have physical meaning. This comes as a big surprise to physicists, who, until these effects were discovered, assumed that consciousness was an unnecessary appendage to the material world.

A clue to the relationship between consciousness and physics is that the enigmas mentioned above are not noticed in everyday life. They occur only at dimensional extremes: at extreme velocities, with extremely small particles, or in extremely strong gravitational fields. They happen where a space dimension is extremely large in relation to time (near light velocity), where space and time are extremely small (quantum mechanics), or, interestingly, where mass is extremely large (general relativity) or extremely small (quantum mechanics). Also, each of these effects involves distortions, discontinuities, or interconnections of space, time, or mass. (It is impossible, for instance, to know at the same time a subatomic particle's location in space and its momentum, or mass \times space / time.) There is something fundamental, therefore, about the relationship between consciousness and the dimensions, something that we miss in the middle latitudes of space and time.

We will make a suggestion now as to what it is that we have missed. We assume that consciousness is inside of space and time. We think of it as a complexity of neural processes somewhere in our heads. If we turn this around and think instead of dimensions within consciousness, a continuity develops between what we call subjective and objective phenomena. Dimensions of space and time contain what we call "objective" phenomena: objective experience is dimensional, subjective experience is not.

There are problems with this, of course, not the least of which is that it does not make sense after a lifetime of assuming its opposite. But I will try to prove in this essay that this is a better and simpler way to understand what we experience in modern physics, and in everyday life.

But what is experience, and what are dimensions? In this essay I will try to show that experience consists entirely of what I call "images," and that dimensions are "potentials" corresponding to "realms" of consciousness.

An image is a thought, a thing, a concept, a feeling, or an object; in fact, it is things, physical and non-physical. It is the sound of a raindrop falling on the roof, or of an airplane in the distance. It is the picture of a place never seen, the memory of a taste experienced long ago, the touch of warm fur, and the pain of standing too long in one position. It is anger and Inst. It is the Andromeda Galaxy, a moon of Jupiter, or a photon. It is a ball rolling down a hill. It is a cloud moving slowly across the sky that puffs up into large white billows, until raked by the wind, and combed smooth into thin wispy strands of smoke. It is an idea that ripples the mind.

Images are slippery and hard to catch. They are like fish in a river: if you reach down and catch one, it squirms and wiggles while you hold it, and slips back into the water.

Everything is an image, and some things that are not things are images. Images are the sole content of consciousness, and constitute, for our purposes, ultimate reality. Reality consists entirely of images in their various forms.

Most scientists feel that images, while real in some sense, are no more than unreliable approximations of the physical world. For them our definition of image may be difficult to accept. We defend it only by saying that what they call the physical world consists of dimensionally-structured images. Some philosophers, on the other hand, particularly those of eastern religious traditions, may feel that ultimate reality lies beyond what we call images. They are right in a sense that we not dealing with here. While we believe that the further progress of science depends upon a transcendence of the material world, we do not, in this presentation, attempt a transcendence of the normal consciousness through which we experience the material world. Eastern thought and practice present a fresh approach to the inner workings of thought, sensory information, and imagination, and an entirely new look at the western scientific tradition. I have found it extremely useful in understanding modern physics. The use of this approach is all we attempt here.

We should admit at this point that defining “image” as ultimate reality does away with the problem of saying what it really is. If it is ultimately real, and there is nothing else, what more can be said? This is exactly my purpose I do not want to know what an image really is, nor how ultimate it may be, at least right now. What I am interested in here is the structural relation among images that creates the sense of physical reality we experience in everyday life. I want to know why, when I experience a visual image and a tactile image at the same time and in the same place, I think of something “out there,” and why this sense of reality is distorted at dimensional extremes.

This theory, then, is an attempt to explain everything in terms of images without saying what an image is. The word itself is one we have had to select and weigh down with meanings, only some of which it can carry on its own. For rhetorical purposes, I have had to stretch and shape it, hopefully not too far beyond recognition. Also, as words are themselves images, none, including “image,” is other than that which I wish to describe. My definition, therefore, is a tautology: We must use an image to impart an image of what I mean by “image.” In any case, the word is the best available for my purposes in that it implies that all things, physical and mental, are essentially fleeting and ephemeral, and that imagination, while fundamentally identical with material substance, is in some sense more fundamental.

Objects are composed of images. You can touch an object because you experience a tactile image where and when you experience a visual image. The “object” is an intersection of images in space and time. It is this particular structure of consciousness, then, that creates the apparent existence of matter within objects.

There are images that are “real” and those that are purely “imaginary.” The difference is that those we call “real” are experienced within a dimensional structure. Their dimensional context means that they are potentially experienced through any of the senses and also by any other observer. Images experienced subjectively are non-dimensional. The difference between “real” and “imaginary” is, We will try to show, the structure of the universe. Mental concepts differ from physical objects only by the context in which they are experienced, a context that we know as space, time, and mass. That they are both images, and therefore composed of the same

primordial substance, I shall have to show. Or, we should say, we shall suggest that modern science has already shown.

But why has it been left to modern physics to discover a fundamental structure of consciousness when physics is not even interested in the structure of consciousness? Like Columbus on his way to India for gold and spices, physics has tripped over something it was not looking for in its search for grand unified theories and ultimate “building blocks” of matter. It has expanded the scope of human experience beyond its own conception of what is real. Before it began its voyages into relativity theory and quantum mechanics in the present century, the human mind was confined entirely to macroscopic dimensions. It is only with explorations inside the atom and beyond the galaxy that we have begun to peer around the edges of the dimensional world.

An image is never complete unto itself, but always relates to other images in some way. A particular image is similar to another in that there is a greater image that contains them both. A red house, for instance, bears some similarity to a green one in that there is such a thing as “house” that contains them both. The larger image serves as a means to locate and identify smaller ones within it. A pain in the jaw can be identified as a “toothache” because it is similar to other such experiences. The United States is a “nation” in that there are other nations like it. We know what an “automobile” is when we see one because we have seen so many others. Conversely, every image consists of smaller, more fundamental images. A toothache is a combination of many separate “painful sensations,” the United States is fifty “states,” and an automobile is a particular arrangement of “bolts,” “carburetors,” and “seat covers.” Conscious activity is a constant arrangement and rearrangement of images into other images, hopefully better, simpler, or more efficient ones. It is always a mind process, and there is no perfect image or system of images containing all the experience. What I offer here, for instance, can be no more than a less imperfect arrangement than that I wish to replace.

One image that contains many others is what I call a “realm.” A realm is a structured part of consciousness, containing a specific form of information. The “perceptual” realms are taste, touch, smell, hearing, and vision. There is also an “observational” realm of consciousness, or of chromosomes in the cells of a particular species. The number of realms is, however, related to our experience as humans (as opposed to plants or animals) at a particular stage of evolution. Plants experience two realms and animals anywhere from two to six. This has to do with the development of specialized sensory organs among higher animals, and of symbolic language among humans and some animals.

Realms are interrelated on the macroscopic level by coordinated dimensions. Three of these dimensions are spatial, and a fourth temporal (as demonstrated by Einstein in special relativity). We will make a case for mass, removed from the concept of matter, as an additional dimension. These first five dimensions are macroscopically distinct and measurable. The sixth dimension, that indicated by non-uniform acceleration, is less easily defined, but experienced in everyday life nonetheless.

The perceptual realms are also interrelated on the quantum level. The visual and auditory realms, for instance, consist of information that is reducible to tactile sensation, and thus to the tactile

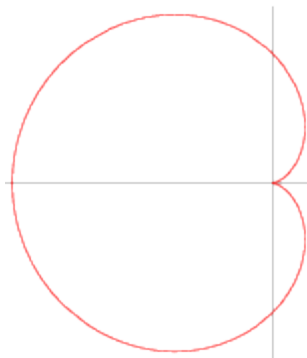
realm. Light is visual consciousness on the macroscopic level but at the same time tactile consciousness on the quantum level: each photon “touches” the retina as it becomes part of visual consciousness. The visual realm is, therefore, an outgrowth of the tactile realm. Extremely small images (objects approaching the energy of photons) are not exclusively visual or tactile (wave or particle) because the dimensional context within which they are experienced begins to disintegrate at this level. This is why we experience enigmas at dimensional extremes.

It is interesting that we notice the dimensional structure of consciousness only where it begins to unravel. We do not notice it in everyday life because it is everywhere.



Fig. 1. Mosaic of Shiite Mosque , Isfahan, Iran [1]

In Fig.1, we present the photo of Mosaic from Mosque in Isfahan, Iran. First of all it is beautiful image which consist a lot of geometric form, cardioids. The name cardioid was first used by de Castillon in *Philosophical Transactions of the Royal Society* in 1741. Its arc length was found by La Hire in 1708. There are exactly three parallel tangents to the cardioid with any given gradient. Also, the tangents at the ends of any chord through the cusp point are at right angles.



The curve given by the polar equation

$$r = a(1 - \cos \theta), \tag{1}$$

sometimes also written

$$r = 2b(1 - \cos \theta), \tag{2}$$

where $b \equiv a/2$.

The cardioid has Cartesian equation

$$(x^2 + y^2 + ax)^2 = a^2(x^2 + y^2), \tag{3}$$

and the parametric equations

$$x = a \cos t(1 - \cos t) \tag{4}$$

$$y = a \sin t(1 - \cos t). \tag{5}$$

It is quite astonishing that artists perform the mosaics full of cardioids without the knowledge of its formula.

In this essay, I discussed the structural relation among concepts (images) that creates the sense of physical reality we experience in everyday life. As an example, I describe the connection between the image of cardioids on the mosaic in Isfahan Mosque, Iran, and the formula for cardioids discovered by Europeans much later.

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