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Space, Time and Consciousness

This paper describes a new theory of consciousness based on previous work by C.D. Broad, H.H. Price, Andrei Linde and others. This hypothesis states that the Universe consists of three fundamental entities — space-time, matter and consciousness, each with their own degrees of freedom. The paper pays particular attention to three areas that impact on this theory: (1) the demonstration by neuroscience and psychophysics that we do not perceive the world as it actually is but as the brain computes it most probably to be; (2) the need to delineate between phenomenal space-time and physical space-time. Recent theories in physics that suggest that the Universe has more than three spatial dimensions are relevant here; (3) the role of consciousness in the block Universe described by Special Relativity. The integration of these topics suggests a new physical theory of the nature of consciousness.

Introduction

The relationship between a consciousness and its brain has traditionally been the subject of two competing theories. The older is dualism. This holds that a human being does not just consist of a physical body with its brain but possesses something extra, ontologically independent of the body. The other is monism that holds that a person consists only of a physical body with its brain and that consciousness is in some as yet undetermined way a product of the brain and of the brain only.

The form of dualism most familiar today is Cartesian dualism. This holds that a person is composed of a material physical organism extended in space plus a mind which is an unextended immaterial thinking spirit. Thus the essential criterion for distinguishing between *res extensa* and *res cogitans* is extension in space. However, there are other forms of dualism. For example, traditional Hindu psychology states that humans are compounded of an extended physical body made of ordinary matter and of an extended psyche made of another form of matter too diaphanous to be detected by ordinary instruments.

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Over the last century, however, a third theory has been developed. This suggests that a human being consists of a physical body made of ordinary matter extended in physical space and, in addition, a consciousness module made of a different kind of matter extended in a different space outside physical space. The meaning of 'outside' here will be developed later. The two are connected by Humean causal interactions.

The impetus to the new theory has come partly from philosophers such as C.D. Broad and H.H. Price, partly from advances in introspective psychology, partly from a developing understanding of certain findings in clinical neurology and partly from recent developments in theoretical physics.

The theoretical physicist Andrei Linde (1990) has suggested that the world consists of three different fundamental constituents — space-time, matter and consciousness, with their own degrees of freedom. My aim in this paper is to explore this hypothesis further. My exposition will be presented in three sections.

1. The role of the brain and consciousness in perception following the demonstration by recent experiments in neuroscience and psychophysics that we do not perceive the world as it actually is but as the brain computes it most probably to be, These findings refute the philosophical theory of perception known as Direct Realism (Smythies, 1994b; Smythies and Ramachandran, 1998). This has important consequences for any theory of consciousness.
2. The need to delineate clearly between phenomenal space-time and physical space-time. This will entail a consideration of recent theories in physics (such as Kaluza-Klein, superstring and brane theories) that suggest that space has more than three dimensions.
3. A consideration of the role allotted to consciousness in the block Universe of Special Relativity.

I: Consciousness and Perception

In the past the postulation of any mental entity additional or external to the brain led to Cartesian dualism as I noted earlier. Descartes used 'extension in space' as *the* criterion to distinguish between mental entities (unextended) and physical ones (extended). However, as I have argued at length elsewhere (Smythies, 1994a) this was probably a mistake. Consciousness has contents — namely sensations, images and thoughts — which we can observe by introspection, as is done during psychophysical experiments. Some of these contents, such as visual and somatic sensations and images, are clearly extended in (phenomenal) space. As Quinton (1962) says: 'My visual sense-data [sensations] are extended spatial entities, occupying positions and spatially interrelated to other things in the space of my momentary visual field . . . My after-image is plainly a spatial thing, it occupies at any one moment a definite position in my visual field . . .'. Other sensations, such as olfactory sensations however, as well as thoughts, lack such extension. For a comprehensive account of the geometry of visual phenomenal space see French (1987). Therefore Descartes' criterion primarily distinguishes

between different contents of consciousness rather that between all such contents and material objects.

Bertrand Russell (1948) puts this clearly:

> The objects of perception which I take to be 'external' to me, such as coloured surfaces that I see, are only 'external' in my private space . . . When on a common-sense basis, people talk of the gulf between mind and matter, what they really have in mind is the gulf between a tactual percept, and a 'thought' — e.g. a memory, a pleasure, or a volition. But this, as we have seen, is a division within the mental world; the percept is as mental as the 'thought'.

Descartes' mistake was, until recently, greatly obscured by the confusion reigning over how perception works. I will therefore turn to the topic of perception.

Perception

Many philosophers today support the Direct Realist theory of perception. This can be put as stating that in consciousness we are directly aware of external physical objects. Phenomenal objects thus really are the same as physical objects (or their aspects, surfaces, etc.). In contrast, the scientific representative theory states that phenomenal objects, together with the space in which they are located, are constructs of the central nervous system and in no sense are they direct views of the external objects that they represent. This controversy has recently been resolved by the results of a large number of experiments in psychophysics. These demonstrate beyond any doubt that, in vision, we do not perceive the world as it actually is, but as the brain computes it most probably to be (see Smythies and Ramachandran, 1998; Kovács *et al*., 1996; Yarrow *et al*., 2001; and see further Vernon, 1962; Gregory, 1981; Ramachandran and Blakeslee, 1998). Visual sensations are not parts of external objects, as the Direct Realist theory holds, but are televisual-like constructions of the representative mechanisms of perception. This fact has the following important consequence. The Direct Realist theory allowed us to account for the ontology of phenomenal space by identifying it with external physical space. But, if phenomenal objects are the *end results* of probability based neurocomputations, this option no longer holds. Thus phenomenal consciousness must be allotted its own real space — phenomenal space. This *may* be identical with some aspect of brain space (however this has to be demonstrated and not simply taken for granted) but not with any aspect of external physical space. It may be argued that since phenomenal space refers to mental sensations etc., which are essentially subject-dependent, it seems implausible to ascribe ontological rather than epistemological status to it. However, sensation involves more than epistemology. In associative agnosia the patient has normal vision but cannot recognize what he/she sees. In other words sensations maintain their ontology but have lost their epistemology. In 'blind sight' the reverse occurs. The patient can obtain valid information about objects that he/she cannot see. Thus I suggest it is legitimate to discuss the ontological status of phenomenal space and its content independently of their epistemological content. In a similar way it is legitimate to discuss the pictures on our TV screens as they are in

themselves (ontology) without reference to what events in the TV studio they may be portraying (epistemology).

The status of the somatic sensations that make up the 'body image' in consciousness is similar. 'Common sense' still believes that the body that we experience during conscious awareness is identical with the physical body. However, neurological investigations of the complex phenomena of 'phantom' limbs show that this is not so (Schilder, 1950; Smythies, 1953; Ramachandran and Blakeslee, 1998). All bodily sensations — including 'phantom' limbs — can be identical only with events in the parietal cortex, not with events in the physical body, to none of which do we have any direct access. As the Viennese neurologist Paul Schilder (1950) said '. . . the empirical method leads immediately to a deep insight that even our own body is beyond our immediate reach, that even our own body justifies Prospero's words "We are such stuff as dreams are made on, and our little life is rounded with a sleep" '.

Wolfgang Köhler, one of the founders of Gestalt psychology, made this distinction very clear (1947):

> Rather, I learned that physical objects influence a particularly interesting physical system, my organism, and that my objective experience results when, as a consequence, certain complicated processes have happened in that system. Obviously, I realized, I cannot identify the final products, the things and events of that experience, with the physical objects from which the influences came . . . My body [somatic sensory field or body image] is the outcome of certain processes in my physical organism, processes which start in the eyes, muscles, skin and so forth, exactly as the chair before me is the final product of other processes in the same physical organism. If the chair is seen 'before me', the 'me' of this phrase means my body as an experience, of course, not my organism as an object in the physical world.

Searle (1992) is one of the very few philosophers to grasp this essential point: 'The brain creates a body image, and pains, like all bodily sensations, are parts of the body image. The pain-in-the-foot is literally in the physical space of the brain.'

My last quotation in this section is from another neurologist — Jason Brown (1991). 'Space itself is an object: volumetric, egocentric, and part of the mind of the observer . . . Mind is positioned in a space of its own making . . . We wonder about the limits of the universe but never ask what is beyond the space of a dream.'

II: The Status of Phenomenal Space

As I adumbrated earlier it is becoming clear that an important aspect of phenomenal consciousness is the ontological status of its spatial system called phenomenal space. As Russell said (1948): 'All this [the physiological account of perception], I say, has long been a commonplace, but it has a consequence that has not been adequately recognised, namely that the space in which the physical table is located must be different from the space we know by experience.' Lord Brain (1955) says much the same '. . . it is essential to recognise the distinction between the space of perception and the space of physics, and between phenomenal objects and physical objects'.

It has been suggested by several people (Broad, 1923; Price, 1953; Kuhlenbeck, 1958; Smythies, 1994a) that the solution to this problem may be that phenomenal space and physical space are simply different spaces, different parallel universes, whose contents are causally related. Here 'different spaces' does not mean that one is real and one is abstract, but that both are real but are topologically external to each other. A real space can be defined as that in which some thing moves about. In which case, the physical body moves in physical space, and the body image (as well as dream images, etc.) move in phenomenal space. The causal relations postulated here are of the simplest Humean type, i.e. whenever a certain event A occurs in a brain a correlated event B occurs in the relevant part of a sensory field or other subdivision of a consciousness. For a further discussion of this topic see Smythies (1994a).

Broad (1923) puts it thus:

> For reasons already stated, it is impossible that sensa [Broad's term for sensations] should literally occupy places in scientific space, though it may not, of course, be impossible to construct a space-like whole of more than three dimensions, in which sensa of all kinds, and scientific objects literally have places. If so, I suppose, that scientific space would be one kind of section of such a quasi-space, and e.g. a visual field would be another kind of section of the same quasi-space.

Kuhlenbeck (1958) says that '. . . physical events and mental events occur in different space-time systems which have no dimensions in common'.

In his recent book Stephen Hawking (2001) says: 'It is a matter of common experience that we live in a three-dimensional space. That is to say, we can represent the position of a point in space by three numbers, for example, latitude, longitude, and height above sea level.' I would comment that this 'matter of common experience' may be merely a visual illusion created by the virtual reality aspect of our mechanisms of perception. It is not at all 'obvious' that we live in a three-dimensional space. It is certainly true that our physical bodies are located in a three-dimensional (physical) space (or 4D space–time). It is also clear than the phenomenal space of consciousness has three spatial dimensions. One needs, for example, three numbers to locate a point in the body image or in a dream. But it may well be that the *co-ordinate systems* for these two spaces are different. That is what it means to say that physical space and phenomenal spaces are different spaces.

The relevance of recent developments in physics

The concept that the Universe may have more than three spatial (or four space–time) dimensions dates from 1917 when Peter Kaluza suggested that electromagnetism is really an extension of the gravitational field into a fifth dimension of space. This theory was supported by Einstein and Bergmann (1938). They say:

> The theory presented here differs from Kaluza's in one essential point; we ascribe physical reality to the fifth dimension whereas in Kaluza's theory this fifth dimension was introduced only in order to obtain new components of the metric tensor representing the electromagnetic field.

Later Klein introduced further dimensions to include the weak and strong nuclear forces into one unified system. Later still superstring theory also postulated that there are ten or eleven spatial dimensions to the Universe. Most recently brane theory has suggested that gravity itself may extend into a surrounding higher-dimensional space. (A brane is a four-dimensional space-time enclosed in a higher dimensional space-time.) As Hawking says: 'Large extra dimensions are an exciting new development in our search for the ultimate model or theory. They would imply that we live in a brane world, a four-dimensional surface or brane in a higher-dimensional space-time.' (Hawking, 2001, p. 180) The significance of 'large' here is that earlier the extra dimensions of space were supposed to be ordinarily invisible because they were rolled up exceedingly small. However, more modern accounts take into consideration the possibility that these extra space-time systems are invisible, not because they are exceedingly small, but because they form a parallel universe or universes. Naturally we can only see physical objects that can reflect light rays. Objects in parallel universes would be outside the range of the light rays in our universe. (Note, however, we experience our own sensations directly without the mediation of light rays. Light rays are among the causal ancestors of our visual sensations.)

However, if the theory of consciousness presented in this paper is correct, then all the contents of consciousness — including our visual sensations — lie in a space, or brane, of their own outside the physical universe. Normal perception, in this theory, is mediated by the causal chain

object–photon–retina–brain–(cross to a new brane)–visual field.

Hallucinations involve only the last part of this causal chain

brain–(cross to a new brane)–visual field.

It is therefore quite in keeping with these trends in physics to suggest that consciousness is located in its own brane further external to the dimensions of the physical world. By that I mean that the new space postulated by this theory to contain a consciousness is not merely a Kaluza-Klein or a superstring space; it is a new space in addition to all currently postulated physical space–times. These provide merely an analogy for a new space of consciousness. The human organism thus may extend beyond the physical body to include a consciousness module (composed of the various sensory and image fields plus perhaps a subjective Self) located in a brane of its own. To coin a pun: 'Consciousness may be in the brane not in the brain.'

III: The Role of Consciousness in Special Relativity

Contemporary 'common sense' thinks of the world as a collection of material objects extended in three-dimensional space and enduring in a separate Newtonian time. Special Relativity unifies Newtonian space and time into space-time. It does not recognize any special universal 'now' of time. Instead, it states that objects consist, not of 3D entities enduring in time, but as 4D world lines existing

and extended from the big bang to the big crunch. For example, the earth is not a spheroid circling the sun, but a stationary hyperhelix wound around the world lines of the sun. Thus the buildings of imperial Rome still stand — it is just that we cannot see them any more. The buildings of future cities already exist — but we cannot see them yet. It should be noted, however, that there is no more a distinguished present in Newtonian physics than there is in special relativity, so all times must be treated symmetrically in regard to the distribution of matter. So, if one wants to account for our psychological impression that there is a 'now' in time and moreover that time in some way flows, we must look elsewhere than contemporary physics, whether Newtonian or Relativity, to find it.

Since I am not a physicist I thought it best to expound much of the argument in the words of the following physicists and philosophers of physics who have addressed this problem:

Louis de Broglie (1959):

> Each observer, as his time passes, discovers, so to speak, new slices of space-time which appear to him as successive aspects of the material world, though in reality the ensemble of events constituting space-time exist prior to his knowledge of them . . . the aggregate of past, present and future phenomena are in some sense given *a priori*.

Stannard (1987):

> Physics itself recognizes no special moment called 'now' — the moment that acts as the focus of 'becoming' and divides the 'past' from the 'future'. In four-dimensional space-time nothing changes, there is no flow of time, everything simply *is* . . . It is only in consciousness that we come across the particular time known as 'now' . . . It is only in the context of mental time that it makes sense to say that all of physical space-time *is*. One might even go so far as to say that it is unfortunate that such dissimilar entities as physical time and mental time should carry the same name!

This position is supported by Lord Brain (1963):

> Moreover when we describe what happens in the nervous system when we are concerned with the movement of electrical impulses in space (i.e. along neurons), and though we use physical time to describe these movements, we can never abstract from such an account time as we experience it psychologically.

Penrose (1994) says that in the universe described by Special Relativity '. . . particles do not even move, being represented by "static" curves drawn in space–time'. Thus what we perceive as moving 3D objects are really successive cross-sections of immobile 4D objects past which our field of observation is sweeping.

Others have come to the same conclusion. For example:

> Quine (1982): 'A drastic departure from English is required in the matter of time. The view to adopt is the Minkowskian one, which sees time as a fourth dimension on a par with the three dimensions of space.'

> Lloyd (1978): 'For the Quinean, what differences we see between past, present and future pertain to our limited mode of access to reality.'
>
> Heller (1984): 'I propose that a physical object is not an enduring hunk of matter but an enduring spatio-temporal hunk of matter.'
>
> Eddington (1920): 'Events do not happen: they are just there, and we come across them . . . [as] . . . the observer on his voyage of exploration.'
>
> Weyl (1922): 'The objective world simply *is*, it does not *happen*. Only to the gaze of my consciousness crawling upward along the life-line [world line] of my body does a section of this world come to life as a fleeting image.'

Werth (1978) makes the important point that this new formulation applies to somatic sensation as well as to vision:

> Our apparent body ['body image' is the neurological name for this] at each instant is simply a 'slice' of our four-dimensional body. That is the experiencing subject sequentially 'intersects' his four-dimensional body and 'projects' the sequence of three-dimensional intersections upon the 'screen' of his consciousness: his body appears to him as being ever changing though in physical reality it is a static and immutable four-dimensional object.

Lastly Broad (1953):

> . . . if we assume one additional spatial dimension beside the three we can observe, and if we suppose that our field of observation at any one moment is confined to the content of a {3,4}-fold which moves uniformly at right angles to itself along a straight line in the {3,4}-fold, then there is no need to assume *any other* motion in the universe. This *one uniform rectilinear* motion of *the observer's field of observation*, together with the *purely geometrical properties* of the *stationary* material *threads* in the four-fold, will account for all the various observed motions (various in both magnitude and direction) of the material *particles* which are the appearances of these threads in the successive fields of observation.

By the term '{3,4}-fold' Broad means a space–time that has three dimensions of space and one of time. By the term a 'four-fold' he means the four-dimensional space-time of Relativity.

Broad also points out that this formulation requires two 'times'. Time 1 has become amalgamated with space into space-time. But a real time — t 2 — is still required in which the 'observer's field of observation' moves through space-time. At what velocity? Eddington (1920) suggested this must be the velocity of light. Time 2 may correspond with Stannard's 'mental' time.

However, these statements raise a problem. De Broglie speaks of 'each observer', Lloyd of 'our limited mode of access to reality', Eddington of 'the observer', Broad of 'the observer's field of observation'. In these instances the terms 'observer' and 'our' cannot refer, as is usual, to the physical body of the scientist, for this is composed of the 4D world lines of its constituent atoms strung out immobile in space-time, as is every other physical object. In contrast, Weyl talks of 'the gaze of my consciousness' and Werth of 'the experiencing subject'. The experienced 'now' of time in a block Universe is where

consciousness, or the experiencing subject, is, not where his or her physical body and brain are. As Alexander (1975) put it '. . . the present being a moment of physical Time fixed by relation to an observing mind'. Thus the observer in a block universe with a shifting 'now' of time must be some entity in addition to the physical body. So how could the conscious observer, or subject with its 'gaze of consciousness', be additional or external to the brain? As we saw earlier the new theory suggests that the consciousness module is indeed external to its brain as it is located in a space (brane) of its own that encloses the phenomenal space of a consciousness.

The question might be asked 'Is our subjective experience of time merely our phenomenal impression of the causal relations between the parallel branes of space-time and phenomenal space?' The answer is that we do not experience these postulated causal relations that connect the contents of the brain located in physical space-time and of the consciousness module located in phenomenal space-time. What we experience are the *end results* of these causal relations — namely our own sensations, images and thoughts.

Conclusion

Linde's theory of consciousness suggests that, in a comprehensive physical theory of the Universe, space-time, matter and consciousness will all become ontologically equal partners in a single over-riding physical reality in a multi-dimensional hyperspace. Linde himself does not discuss what the nature of consciousness might be other than its independent ontology. Nor does he comment on what might be the nature of the relations between a consciousness and its brain. However, some of the details of this hypothesis have been filled in by the people quoted such as Price, Broad, Russell and myself. My own contribution to this theory is to present the case that a consciousness may have its own space–time system and its own system of ontologically independent and spatiotemporally organized events (sensations and images) that have as much right to be called 'material' as do protons and electrons. Price (1953) and I also have suggested that the relations between a consciousness and its brain are causal.

So the new formulation of reality might consist of the following ontologically equal partners — (A) physical space-time (10 or more dimensions) containing physical matter (protons, electrons, etc.); (B) phenomenal space (3 more dimensions of a parallel universe) containing mind stuff (sensations and images); and (C) real time (time 2). A and B are in relative motion along the time 1 axis *in* time 2. Their contents are in causal relations via the brain. The psychological 'now' of time marks the point of contact of the two systems.

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