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Abstract

If we take seriously literal interpretations of quantum theory and general relativity then the question posed in the title is no. This article highlights where incompatibilities arise by considering our experience in the context of modern physics. Implied nonmaterial minds possess a property that no physical entity does – localisation in the configuration space. The principle of localisation (PL) is proposed, and is used to show that there is no need to resort to the Everett interpretation to show that minds exist outside of physics. Post relativity physics is enough. However, in this regime, there is no free will, minds are destined to experience a pre-determined but unknown future. Free will is restored when we reinstate the Everett interpretation of quantum theory.

Keywords: Configuration space, dualism, physicalism, quantum mechanics, relativity, timelessness.

1. Introduction

There has been a longstanding philosophical problem in reconciling the consequences of modern physical theories with our everyday experience of the world around us. This apparent inconsistency can be addressed by considering the conflicting viewpoints as independent postulates in order to see what lessons can be drawn. These postulates can be stated as follows

P I **Eternalism: Physical reality consists solely of a timeless wave function over a universal configuration space.**

This asserts the underlying static nature of material reality of which physical time is just one aspect. The second postulate is equally important and addresses the subjective nature of our experience, this reads:

P II **Experience: Our conscious dynamic experience of the world is real.**

A likely cause of this inconsistency is the physicalist position that is tacitly assumed, where the experience leading to the second postulate is claimed to be an illusion. Elucidating the contrasting properties of minds and the material of the universe they find themselves in, provides an important first step in extricating ourselves from this difficulty. The universal wave function, which encapsulates the material universe, has the properties of being timeless and distributed over the classical configuration space (C-space). By contrast minds are localised and dynamic within C-space, as we experience ourselves to be. This localisation is deduced directly from our common experience of a single classical configuration at any

instant. This is the principle of localisation (PL), and is an idea that evolved from *localisation of consciousness* in the Hilbert space of quantum theory (Zeh, 1970, p74).

A significant first step in this direction was due to Albert and Loewer (1988), which had the aim of reconciling Everett's interpretation of quantum mechanics (Everett, 1957) with everyday experience. This has been supported by subsequent work with respect to the new dualism, for example (Bitbol, 1990; Squires, 1993; Hemmo and Pitwosky, 2003). Despite these authors' agreement on dualism, their respective interpretations of minds do differ. For example Squires' approach introduces the concept of a universal mind in contrast to the *many minds* of Albert and Loewer. However, in this work it is not my purpose to discuss the configuration of minds and how they may relate to each other or to the physical world, it is only to show their independent existence. I do this by appealing, not just to the Everett interpretation, but to modern physics as a whole.

The work of these authors, being written in the context of the Everett interpretation, provided reasons for others, possibly with physicalist leanings, to attempt a refutation of Everett, examples include (Byrne and Hall, 1999; Adler, 2014). While others, for example (Lockwood, 1996; Deutsch, 1996; Saunders, 1998; Greaves, 2004; Lewis, 2007) instead try to maintain a physicalist position in the face of Everett. In what follows I show that this is not possible. Moreover, it is shown that that mind-body physicalism is untenable in all post-relativity physics as interpreted at face value.

There are two key concepts, already mentioned, that need to be addressed in order to see the distinctness of minds and the physical world. These are (i) the timelessness and extended distribution of the wave function and material objects it encapsulates, and (ii) the localisation and movement of minds. In the following section I discuss timelessness by showing how physical time emerges from an essentially static reality. This is done by summarising the *problem of time* in the context quantum gravity, and then to show how classical[1] relativity can also be considered as a timeless system. Provided a reader, unfamiliar with the physics, accepts an eternalist's interpretation of time (B-theory (McTaggart, 1908)), then this section can be safely skipped without compromising the message. Timelessness provides the groundwork for the following section on consciousness and the principle of its localisation. Before concluding I include two more sections, one on Papineau's physicalist criterion (Papineau, 2001) and where it fails in the face of PL, and the other dedicated to PL as applied to Parfittian examples (Parfit, 1984).

2. Timelessness

Here I provide a brief overview of modern physics, by which I mean physics post-special relativity. Before relativity the state of physics was such that the scientific community could not easily decide between presentism and eternalism, a debate dating back to Heraclitus and Parmenides *c*. 500 B.C. Generally due to the way language had evolved, time was tense dependent, so the way people thought about time could, more easily be represented by A-theory, which is more consistent with Bergson's (1910) position. From a Newtonian viewpoint the ontology of time was not considered to have the same status as physical space. Essentially everything happened in $\mathbb{R}^3$ which represented the whole of physical reality in the present. The past did not exist, it was only remembered, and the future had not happened yet

[1] Here the word "classical" is used to indicate that we are not considering quantum mechanics.

therefore that did not exist either. This is how Saunders (2002) for example, defines *presentism*[2]. Given the causal relationships of events in this scheme and the causal closure of physics, it is easy to see how this opened the door to physicalist views. Later I show that mind-body physicalism today is really nothing more than a relic from the pre-relativity paradigm.

Much of the confusion about time is between physical time and its phenomenal counterpart (Bergson, 1910). In April 1922 Albert Einstein famously disagreed with the philosopher Henri Bergson over the nature of time. Einstein's position was reflected in his theories of relativity, whereas Bergson pointed out that the cold objectivity of Einstein's view could not account for time as experienced duration. Moreover in general relativity both past and future perdure suggesting an unknown but predetermined future, which Bergson could not accept. In Bergson's view the future must be open, and this is addressed by adopting the literal interpretation of quantum mechanics. One possible solution to this impasse was that neither Einstein nor Bergson considered that they were defending entirely distinct concepts. Einstein's view of extended objective spatialised time, contrasted Bergson's inner phenomenal time that we experience as duration. This view of time mirrors the dualistic nature of ourselves as proposed here.

Considering quantum mechanics, many philosophers attempt to preserve physicalism even in the context pure wave theories. For example Ismael (2003) points out the tendency of Everettians to invoke nonmaterial *homunculi* in order to solve the measurement problem. But as we will see this is done with good reason. Before delving into those reasons however, we need to consider pure wave theories in a wider context. These interpretations emerged as a result of efforts to describe the universe as a whole within a quantum context – all observers are internal to the system. When considering this, then as remarked by Deutsch (1996), the Everett interpretation is the only interpretation of quantum mechanics. That wider context is canonical quantum gravity (CQG), which appeared ten years after Everett. Described as its most disturbing feature, timelessness in the objective world is manifest when we express the short form of the Wheeler DeWitt equation (DeWitt, 1967; Zeh, 2007 and references therein)

$$H\Psi = 0 \tag{1}$$

and realise that no time variable is present in the arguments of the universal wave function, Ψ. A central question to be addressed is: given the timeless nature of physical reality how is it that we experience change? We are able to give a partial answer here, for further details see (Austin, 2020, mainly chapter 10).

The Wheeler DeWitt equation can be compared with the standard Schrodinger equation

$$i\hbar\frac{\partial\psi}{\partial t} = H\psi \tag{2}$$

where ψ is the wave function for a particular microscopic system being analysed. Here we see an obvious time dependence of ψ. The form of Schrodinger's equation, (2), would be

[2] There is an alternative version of A-theory known as the "growing block". This is where the past and present exist but the future does not. This version of A-theory, which strictly is a hybrid between eternalism and presentism, still requiring a privileged present, is not discussed in this work; therefore here, the terms 'A-theory' and 'presentism' are interchangeable.

typically used in a laboratory setting to analyse the behaviour of a particular experiment. When a WKB ansatz is inserted into an expanded form of equation (1) the Tomonaga-Schwinger equation, is obtained (Zeh, 2007, p190). Using this and taking χ as the pre-exponential factor in the WKB form we obtain

$$i\frac{d\chi}{d\tau} = H_{matter}\chi\,. \tag{3}$$

In units where $\hbar = 1$ the similarity in form between (3) and (2) is striking. Here the time parameter, τ is what Zeh calls many fingered time (or what relativists call proper time). But taken in a wider context it is nothing more than a real valued parameter on a Bohmian trajectory through C-space. This provides a rudimentary but effective idea of how physical time emerges from a timeless universe. Moreover, a simple way of seeing the timelessness of CQG is to eliminate the time dependence of ψ in (2) ($\partial\psi/\partial t = 0$), and see that it immediately reduces to the form of equation (1).

A question prompted by this conclusion is: if time does not exist at a fundamental level then is there something else to replace it? There is, it is the configuration space itself, also called the universal C-space. Unlike time with topology $\mathbb{R}$, C-space is for all practical purposes infinite-dimensional. It is in C-space, *C*, that the Everettian multiverse resides in the form of a branching wave function. The topology of physical reality can then be represented by $C \times X$, where *X* is the topology of the base space (most likely S^3 or $\mathbb{R}^3$). This may also be called space-C, where C-space replaces *time* in space-time (Austin, 2020, section 6.5.4). What we think of as time is reduced to a single parameterised path with topology $\mathbb{R} \subset C$, which reduces to an ordered sequence of configurations. For further details of emergent time see (Barbour, 1999; Zeh, 2007), and for more general treatments of CQG see (Rovelli, 2003; Thiemann, 2007).

To summarise, physical time is defined as a parameter on a particular path through C-space, it is merely an ordered sequence of configurations. This is a path of the entire universal base space, *X*, and all of its matter contents through its own configuration space. So it is possible to isolate a particular path in C-space, to obtain a structure with topology $\mathbb{R} \times X$. This is what we perceive as classical space-time. Moreover, in this structure, time has been placed on an equal footing with the base space, *X*. We no longer have the presentism described by Saunders where time is just something ontologically distinct from space, instead we have a situation where time is part of the geometry. This is how timelessness manifests itself in classical relativity. Time is within physics as opposed to being outside it.

I have, admittedly on a very basic level, shown how the classical block space-time of general relativity is derived from the Wheeler DeWitt equation. The perdurance of physical time, has inescapable consequences for conscious minds. Time in eternalism is tenseless. As a consequence we can say that *past events exist* (deliberate present tense). In classical relativity both past and future events exist, they are just elsewhere in C-space. We can illustrate this by a simple thought experiment, involving the relativity of simultaneity, which has become known as the Andromeda paradox (Rietdijk, 1966; Putnam, 1967; Penrose, 1989, p392-393).

Consider Alice and Bob, walking along a street in opposite directions. The constellation Andromeda just happens to be on the horizon in the direction that Alice is walking. On a

planet in the Andromeda Galaxy (M31), 2.4million light years away, there is an event, E_A, simultaneous to Alice when she passes Bob. Similarly we may consider an event, E_B, at the same location on that distant planet simultaneous to Bob when he passes Alice. Intuitively E_A and E_B are the same event. Relativity denies this, actually E_B occurs approximately nine days earlier than E_A assuming a relative velocity between Alice and Bob of 3 ms^{-1}. We can consider a third event, E_0, exactly half way between E_B to E_A, which will be repeated many times in both a backward and forward time sense for Charlie who walks in a circle just across the street from Alice and Bob as they pass each other. Despite this being beyond direct experience, due to the spacelike separation between events here and in M31, this thought experiment indicates the perdurance of E_0 in support of eternalism.

Another way to see how time emerges from timelessness, at a microscopic scale, is to include a clock in a closed quantum system that is in a static global quantum state. The clock in this case is just a subsystem possessing an associated time variable, correlated with the rest of the system. Page and Wooters (1983) with later refinements by Gambini *et al* (2009), have shown the possibility of creating a static entangled state with internal *dynamics*. An experiment by Moreva *et al* (2014) shows a static quantum state of two entangled photons when passing through birefringent plates that rotate the polarisation of individual photons. In one mode one of the photons was seen to evolve with respect to the other (the clock), that is their polarisations are correlated, while in another mode the collective state of the photon pair was observed to be static.

One may ask if presentism can be dislodged entirely or whether it can represent the truth based on a hidden inertial frame that defines a universal present. In this way the universe may consist of a single three-dimensional space evolving dynamically where the models of a four-dimensional block space-time, or a higher dimensional space-C, are entirely illusory. The only classical way I can think of to dispel such an idea would be to obtain direct evidence by, for example creating closed timelike loops. However, this approach seems unlikely to succeed (Hawking, 1992; Flannagan and Wald, 1996). More direct evidence for the eternalist's view however, does present itself via the empirically known existence of macroscopic-Bell states whose quantum volumes exceed that of the whole of classical space-time by many orders of magnitude (Iskhakov *et al*, 2012; Kanseri *et al*, 2013). For more detail see (Austin, 2020, section 6.6).

Although we can now see how internal dynamics can emerge from microscopic static systems, there is still something missing because there is no observer to experience the implied dynamic processes. Moreva's experiment shows two variables that are correlated in an entangled system. It is like laying two rulers side-by-side and saying that their respective scales are correlated. Although we have a system that is physically complete, there is still no *pointer*. It is like staring at a clock face with no hands. However, we are able to identify ourselves as pointers localised at a specific point in time for every instant. This is the principle of localisation.

3. Nonmaterial minds and the principle of its localisation (PL)

The principle of localisation is the theory that, at each instant, your mind contacts the physical world at one point in C-space. Therefore, you percieve your mind to be localised at one point in time at each instant. As an example, suppose you are meeting friends at a restaurant. You are a few minutes late. As you enter you accidentally stub your toe on the

doorframe, it hurts. Resisting the temptation to let out an expletive, you proceed with a slight limp to the reserved table where your friends are already seated. Over a drink while waiting to order, you relate your recent experience to your friends. At this point, what can we say about the event when you stub your toe? This is an event in your past, you have memory of it, in addition, the state of your nervous system and the tissue neighbouring the impact point is such that you are still feeling its effects. These effects are with you now. Taking a presentist's view of time the event itself no longer exists. However, as we have already seen, it is eternalism that is favoured in the current scientific paradigm. Therefore the event where you stub your toe on the doorframe exists, it is just not where you are now. Even accepting eternalism, our common experience tells us that we only experience one instant at a time. That is in classical physics we really are localised in time, it is just that, unlike specific events, our locality moves with respect to our own phenomenal time – only minds change their configuration and state, this is the source of phenomenal time. In presentism, due to the *non-existence* of the past and future, minds are confined to the present, i.e. localised, but the present is privileged. Whereas for the eternalist there is no privileged present and no such constraint exists – the present is just where you are.

To relate this to physicalism, at the point where you experience stubbing your toe on the doorframe you, your mind, is at that point. Where you experience being seated with your friends, the event in question still exists. So the question that physicalists must answer is: what is the difference between an event when you experience it, and the same event when you refer to it later? For any eternalist this should be regarded as a legitimate question. In modern physics, the physicalist view implies that your mind could take the form of a localised physical disturbance, say a soliton or other type of localised wavepacket that moves along your world line in space-time in relation to phenomenal duration. The problem is that space-time is by definition static – physical time is internal to the physics. So no such disturbance can exist. Does this mean that we must deny our own existence? Obviously not but, if we identify ourselves as localised minds, we must take the bold step of denying our own physical existence, and regarding our bodies and brains as structures to which we are temporally associated.

The reason this is important is because our material bodies (and brains) are, unlike our minds, distributed over time. To use Parfitian language, our bodies are objects extended over time, with features that vary along with many overlapping connections (causal relations). All of the body's features and connections collectively constitute a personal-identity-over-time. But because this structure is extended in time it is legitimate, given our common experience of localisation, to treat it as purely physical. This is precisely what Parfit does. However, in the light of PL it is difficult to see how physicalism can be maintained. A comment by Acton (1960) that in my view nicely summarises one motivation for physicalism (materialism), is quoted as

The strength of the case of materialism is a result of the obscurities in the notion of a wholly incorporeal existence. This is held to be non-spatial and hence incapable of movement. But then its mode of operation on and with material bodies seems inexplicable. (Acton, 1960, p195)

A key phrase here is …*obscurities in the notion of a wholly incorporeal existence.* Yes there are obscurities. However, the extension of physical bodies over time coupled with the localisation of minds is anything but obscure – the difference is manifest. With regard to the second sentence it is difficult to be sure what is meant by *non-spatial*. Minds are certainly

localised in time (or in C-space), and our brains occupy small but well-defined regions of base space to which our minds are associated. It would appear that minds move in a more general space than just the base space. The last sentence asserts the inexplicability of the effects on material bodies by minds. When we come to discuss Papineau's criterion it will be seen that this point is wholly irrelevant.

One of the strongest proponents of physicalism in the context of modern physics, specifically of the Everett interpretation, is Michael J Lockwood. In his (1996) article he attributes minds as branching entities just like features of the wave function. From someone presupposing physicalism this is to be expected. He describes your multimind (Mind) as being distributed across a local region of the multiverse (a subset of C-space) containing copies of you. Every copy has its own mind each of which is a branch of your Mind. He describes a *superpositional* dimension orthogonal to time over which various mental states are distributed. Together with time this forms an *experiential* manifold, within which each individual mind, including yours, occupies a vertical line (its own time). From each point you can look back via the faculty of memory, along your own timeline. Lockwood uses the analogy of *tunnel vision*. You can also look at other locations in base space to points in and on your past light cone via sensory input still within your own branch. Also, as Deutsch (1996) points out, you can gain input indirectly from neighbouring timelines via interference. All this describes the physics perfectly. However, when it comes to the interpretation of minds in the context of experience related to modern physics then Lockwood's description is incomplete. But even Lockwood, when he refers to *tunnel vision*, alludes to PL – who or what is looking along the tunnel?

Let us consider the *tea/coffee* example that Deutsch (1996) relates near the beginning of his supportive reply to Lockwood. As he was drafting his article he was experiencing drinking tea. Through his firm grasp of quantum theory he could also perceive a neighbouring timeline where he is drinking coffee. He did not experience drinking coffee at that point. That was the experience of a separate individual who has the same name, identical DNA and near identical biography. In addition there will be a branch point in his near past, to the past of which both David Deutschs (the tea drinking version and the coffee drinking version) followed identical paths through C-space. I myself am on Deutsch's tea-branch because that is what is described in the copy of his article I have in front of me as I write. There will be many versions of the tea-branch, all subtly different, but I refer to it singly for reasons of clarity. There will be copies of me (physically) writing this article now but with the words *tea* and *coffee* switched, because those copies are referring to the article written by the coffee drinking David Deutsch. But those copies are not me because, in this life, I was not in that part of C-space. And when you read this article I will no longer be at the point where I am writing these words, I will have moved on because, although I am localised in C-space, I am moving through it along my own timeline as percieved with respect to my own phenomenal time.

Lockwood's view of minds fails PL. This is because, in his view, minds are subsystems of brains, which are static and distributed across extended subsets of C-space in the form of branching timelines. The reason given by Lockwood for this view is that he follows the principle of *supervenience of the mental on the physical*. He effectively presupposes physicalism. This is unconvincing, we cannot use physicalism to prove physicalism. However, I can offer a weaker form of the supervenience principle that does not demolish the consistency between eternalism and PL. Consider a body of water held in a container. We can say that the shape of the water supervenes on the shape of the container. This is not the same as saying that the water supervenes on the container. Here supervenience relates only to its

shape. I can easily pour the water away, in which case the water and the container continue to exist separately. Similarly we can say that mental states supervene on brain states: referred to as local supervenience (Austin, 2020, p292). This makes sense because the state of a particular mind can supervene on the instantaneous state of a brain at the corresponding point of its Bohmian trajectory. But it makes no sense to say that localised minds supervene on brains extended in C-space. Let us see how this further relates to the measurement problem of quantum mechanics.

The measurement problem with respect to a two state quantum system, typically the spin-state of an electron along a predefined *x*-axis, is often used when discussing the minds of interacting observers. A clear analogy, used by Peter Lewis (2007), is one of a forked road with each fork leading to different destinations. Consider Saunder's (1998) argument regarding the measurement of the spin state of an electron emerging from a Stern-Gerlach apparatus. The electron is prepared in the state

$$\frac{1}{\sqrt{2}}\left(\left|\tfrac{1}{2}\right\rangle+\left|-\tfrac{1}{2}\right\rangle\right)$$

But when measured its state becomes either $\left|\frac{1}{2}\right\rangle$ or $\left|-\frac{1}{2}\right\rangle$ with probability of $\frac{1}{2}$ for each case. In the forked road analogy the main road (pre-measurement) splits with one branch heading for Upton ($\left|\frac{1}{2}\right\rangle$) and the other heading for Downham ($\left|-\frac{1}{2}\right\rangle$). Lewis considers the three options analogous to seeing the electron spin in: both states, neither state or, one or the other. These are Saunder's three options (Saunders, 1998, p11). Any physicist will know that a classical observer will always measure the latter. In response to Saunders' three options he states that just as the post-junction segments of a forked road are physically continuous with the pre-junction segment, then a pre-measurement person stage is continuous with its two post-measurement stages. In Lewis' analogy the post-fork segments head for Upton and Downham to appropriately reflect the spin eigenstates of an electron after measurement. Here road_1 is the road segment at x_1 before the fork whereas $\text{road}_2\uparrow$ and $\text{road}_2\downarrow$ are road segments at x_2 after the junction heading for Upton and Downham respectively. Then he makes the case for which is the appropriate question to ask.

The analogous question in the road case is this: Which road (if any) does road$_1$ become at x_2? (Note that the question is not ''Where will I get to if I drive along the road to x_2?''; the analogy is between the road itself and the Everettian person.) (Lewis, 2007, p3).

The argument here is about which is the right question to ask. If you are a super-observer seeing the entangled state of the electron, apparatus and experimenter collectively, then the right question is, as Lewis states: *Which road (if any) does road$_1$ become at x_2?* However, if you are the experimenter, the right question, contrary to Lewis' claim, is the one in brackets: *Where will I get to if I drive along the road to x_2?* In other words what state of the electron spin will I experience seeing? Here we are appealing to postulate *PII* in the introduction. When considering internal observers the question is about their experience. The confusion in the analogy is between the road and the traveller. In the experiment the confusion is between the experimenter's body/brain (the road) and the experimenter's mind (the traveller). In order

to avoid this confusion it is necessary to state whether we are referring to physical or mental[3] aspects. This is not some Rylean category mistake[4] either; although minds are subjective their existence is an empirical fact. In this case it is our common experience that forces us to select the latter type of question rather than the former. Minds experience classical states because of their tightly defined locality in C-space. They never experience superpositions, and they do not normally experience temporally separated events at the same instant.

Assertions by, for example Greaves (2004) and Ismael (2003), that nonmaterial minds are unnecessary to define local branching probabilities in a deterministic Everettian universe, are fine on a physical level. However, at a mental level the question: what will I experience? is very pertinent. Greaves (2004, p440) makes incompatible statements similar to Lewis' with regard to experimenter, Alice, when measuring an electron's spin state:

…we get the following: the personal-identity-over-time relations among the person-stages are such that, according to our counterpart-theoretic account of talk of the future, $Alice_1$ will become $Alice^{up}_2$; and $Alice_1$ will become $Alice^{down}_2$. Similarly, $Alice_1$ will see spin-up, and $Alice_1$ will see spin-down. (Greaves, 2004, p440)

The first sentence is about the physical situation, which is fine. In the second, however, Greaves makes a statement about experience. She refers to the minds of $Alice_1$; "*$Alice_1$ will see…*" But the $Alice_1$ that sees spin-up is not the same individual as the $Alice_1$ that sees spin-down. They are distinct individuals that, up to the measurement, have travelled the same path in C-space. Greaves does adopt a similar position to Lockwood with regard to supervenience of the mental on the physical. Hence she presupposes physicalism. This is the reason she identifies the two sentences. We see that in an Everettian universe adopting a physicalist position can result in statements asserting that single *individuals* experience mutually exclusive events, contrary to common experience.

From Ismael (2003) it is difficult to ascertain whether she adopts a physicalist position. She seems neutral on the point and her only concern is to show that probabilities calculated from the Born rule are independent of nonmaterial minds moving through the branches. There is no problem here. But she seems to believe that the reason Everettians postulate the existence of non-physical elements is to solve the probability problem in a branching histories context. It is not, it is because each non-physical element (a mind) is located at one point on one branch at any instant. Probability is a relevant topic but, as she shows, it is a natural part of the physics.

At an abstract level we can regard physical reality as a set of correlated static scales (variables), any one of which we could designate as a clock. However, by itself there is no pointer and we are left with a timeless, empty landscape. The pointer, required to complete the picture, is you. You are the pointer moving along the scales inexorably in the direction of increasing information, knowledge, entropy, Everett branching or whatever, at least during the period of your physical life. Consider the now famous quote by Hermann Weyl (1949) used by both Saunders (1998) and Zeh (2007)

[3] Here 'mental' refers to a non-physical aspect, the minds perspective continuously changes but the physics does not.

[4] Gilbert Ryle (1949): Ryle's condemnation of dualism as a *category mistake* relies entirely on the causal closure of physics (page 8… of the 60th Anniversary addition).

The objective world simply is, it does not happen. Only to the gaze of my consciousness, crawling upward along the lifeline of my body, does a section of this world come to life as a fleeting image in space which continuously changes in time. (Weyl, 1949, p116)

Saunders describes the feeling of the passage of time as being tenacious, and interprets the above quote as Weyl's attempt to dislodge it. I do not interpret Weyl's statement that way, he simply says it as it is – the previous and subsequent passages in his book do not bear this out. Consider also Saunders' subsequent statement

If my consciousness crawls up the life-line of my body, then it departs from one time, t_1 *and arrives at another* t_2*; in which case my body at* t_1 *has no consciousness,… But if it does not, then my consciousness is at both times at once, an absurdity.* (Saunders, 1998, section 4.2)

In contrast, on the relationalist account, the movement of consciousness is already described by the life-line, in terms of the relations among its parts; nothing crawls up my life-line, my life-line already depicts change. (Saunders, 1998, section 4.2)

The first paragraph describes the situation perfectly. The second describes the physics of the situation but not the experience of it. To say that *nothing crawls up my life-line*, is inconsistent with experience. Here Saunders seems to be confusing physical time with phenomenal time. Phenomenal time is, like other qualia, a function of one's own mind, it is sometimes referred to as psychological time or experiential time. During our lives these two time parameters are monotonically related. As the statement (…*is at both times at once, an absurdity.*) implies, it is not to be at both times at once, as Saunders clearly states; but the crucial point is that both times exist at once (eternalism), and consciousness is localised (PL), so at the instant when a mind contacts one point in physical time it cannot be at another. The only way to make sense of Saunders' statement here is to deny eternalism.

Relational theory is perfectly in tune with the physical landscape. However, the phrase …*already depicts change.* refers to the life-line of a person's physical aspect. To say that something depicts change is not the same as saying that that something changes. I can draw a space-time trajectory of a particle on a blackboard complete with position and time axes, and say that it depicts a moving particle, while the picture itself remains still. Likewise a life-line can be perfectly static and yet still represent the experienced dynamics along its route.

Saunders refers to *my body* having *no consciousness* in the past, and many find this idea unpalatable. But the body has no dynamics, it is part of a universal timeless landscape. Your experience of movement and change comes from your mind's movement through that landscape. The so called *mindless hulk* problem is a small price to pay when we consider that the branches of the wave function, and consequently our bodies and brains etc., form part of a timeless landscape that may be travelled repeatedly by many minds.

There are those who will say that common experience is merely an illusion. Those that do need to have good justification for such a position. Examples cited often invoke the counterintuitive nature of relativity or quantum mechanics. So our common experience is also likely to be counterintuitive. But there is a distinct flaw in this kind of argument. The effects at the extremes where these physical theories are needed diverge significantly away from Newtonian predictions. In the Newtonian paradigm we would get an inaccurate model at the extreme scales and velocities where modern theories are applicable. As the earlier paradigm

would demand, we would have extrapolated using Newtonian mechanics. The difference here is that it is the everyday world we are considering – there is no extrapolation. The reason we experience one instant at a time is because we are only associated with one point on the physical timeline at a specific instant of our phenomenal time. Similarly we do not see neighbouring Everettian branches because of our tight localisation in C-space due to being confined to one branch.

A separate but related issue to the one of conscious minds is free will. As we have seen in the discussion of the block space-time model of general relativity that encompasses eternalism is that, due to PL, minds have an independent existence from the physical. But in classical relativity there is only one pre-existing future. So conscious subjects are bound to experience a pre-determined but unknown future. It is not until we invoke quantum mechanics that we reinstate an open future that we can genuinely influence. This is a consequence of the branching structure of the wave function in an Everettian universe. Through our choices and actions there is the feeling that we can affect the experienced world. But we do not affect anything in an Everettian context. However, we have a measure of control over the course of our Bohmian trajectory through C-space. This is summed up by the following sentence by Squires (1993)

The conscious mind does not change physics, it selects from it. (Squires, 1993, p119)

Squires goes on to speculate about the possibility of influencing quantum events in the outside world by choosing which branch to take when doing, say a spin-measurement. This would constitute a form of quantum telekinesis that, as Squires remarks, seems unlikely. But it does suggest two distinct classifications of branching event – those we can influence and those we cannot. It is likely that those that do fall under subjective influence are branching events in appropriate parts of the brain. Those in inappropriate parts, such as those governing autonomic functions and those in the outside world are categorised as being beyond our direct influence – these are purely stochastic. Tentative progress has already been made regarding branching events that may be subjectively influenced. It is speculated that coherent quantum states constantly form then decohere within microtubules in the neuronal structures of the brain (Hameroff and Penrose, 1996[ab]; Penrose, 1997 and references therein). This is likely to remain work in progress for many years to come.

This section concludes with a few remarks regarding another possible motivation for physicalism. This is the tendency by physicists to want to unify their theories. Moreover unification is a likely motive for any form of monism. So what can we say about the discussion so far? A common feature within modern theories of mathematical physics is duality. Examples of pairs that are dual to each other include: vectors and one-forms in tensor algebra, electrical charge and magnetic flux in electromagnetic theory. Other examples are logical truth-values true and false, yin and yang in Chinese culture… The point is there are many instances where a unified whole can contain parts grouped as complementary pairs – duality. In the universal wave function we have an entity that is static and distributed over the whole of C-space. A mind by contrast is something that is dynamic with respect to its phenomenal time, and is localised. So we see aspects where mind and the wave function complement each other in certain ways. Whether they are dual to each other within some, as yet undiscovered unified scheme remains to be seen. But it seems sufficient to question unification as a serious motive for physicalism.

4. Papineau's physicalist criterion

In this section I concern myself with another motivation for physicalism – causal closure. Previously mentioned motives include: the tendency for physicist to unify their theories, and obscurities concerning incorporeal existence, spatial location and the causal relationship between mind and matter (Acton, 1960). It is the latter, which is of most concern and the established causal closure of physics seems to be the strongest motivation for physicalism (Papineau, 2001). In his essay *The Rise of Physicalism* Papineau summarises the physicalist argument as follows

Premise 1 (the completeness of physics):
All physical effects are fully determined by law by a purely physical prior history.

Premise 2 (causal influence):
All mental occurrences have physical effects.

Premise 3 (no universal overdetermination):
The physical effects of mental causes are not all overdetermined.

Conclusion:
Mental occurrences must be identical with physical occurrences. (Papineau, 2001, p9)

To deny the conclusion we must deny at least one of the above three premises. If we are unable to do this then we must accept the physicalist's conclusion. In the context of this work and given the current state of physics, we accept causal closure (premise 1), thereby relieving ourselves of the burden of challenging this premise. Turning our attention to premise 3 for a moment it is also reasonable that experienced physical effects due to mental causes are not overdetermined. Here we may imagine a physical effect in the brain having both a physical cause and a separate mental cause, this would be overdetermination. One might ask what the result would be if these causes were in conflict. However, since it is my intention to accept premise 3 also, then such a conflict has no relevance. Therefore if we are to deny physicalism then we must challenge premise 2.

Premise 2 states: *All mental occurrences have physical effects*, whereas the quote by Squires, in the previous section, states: *The conscious mind does not change physics, it selects from it*. Certainly in the context of the Everett interpretation we have denied premise 2. Also we have seen that the classical block space-time is timeless implying that it cannot be changed either. So the conscious mind does not change the physics, it merely moves through it. However, in our discussion of free will we find that in classical physics there is only one pre-determined future. We need the Everett interpretation to allow free will as well as a dualist interpretation of mind. As was mentioned in the previous section, Acton's quote: *But then its mode of operation on and with material bodies seems inexplicable.* has been shown to be irrelevant since minds have no effect on the pre-existing physical landscape. The real weakness in the physicalist argument is premise 2, and is easily denied in the current paradigm.

5. Parfitian examples

Here we consider some of the consequences of what has been said so far in relation to a selection of well-known thought experiments (Parfit, 1984). These were designed by Derek

Parfit to test his own reductionist ideas regarding personal-identity-over-time. Although he writes like a physicalist he does state that physicalism is not a requirement of reductionism. If reductionism is applied only to physical systems, then reductionists can be dualists as well (Parfit, 1984, p241). This way we know that Parfit is applying his ideas only to physical systems. So we might expect similar types of statement as those from Lewis, Greaves and Saunders for example. Although Parfit does not consider quantum mechanics and its Everettian consequences, some of his thought experiments do consider structures that bifurcate in time, which makes them very pertinent.

Teleportation: The first of Parfit's scenarios concerns a simple teleportation between Earth and Mars. The subject about to be teleported is concerned that when he is disintegrated at the Earth based station, he will simply die and be replaced by a reintegrated copy at the Mars station. Post teleportation the copy is physically identical, at atomic resolution, to the original. He even notices the small cut on his top lip from his morning's shave. It seems plausible that a physicalist would have no need to worry about such a process. But how would a dualist react? Would an associated mind (what Parfit calls a *separately existing entity*) permanently detach from the physical world at the point of disintegration, or would it remain associated with the subject's body pattern as it is stored in the buffer, transmitted over a few tens of millions of miles as a radio signal, re-buffered and reintegrated at the Mars station? The honest answer is that we do not know, but PL does allow for both options. So, even if we could prove beyond doubt that minds do exist independently, then we do not know enough to be able to say whether a nonmaterial mind could remain associated with a body's blueprint undergoing the hypothetical process of teleportation. For the sake of argument let us suppose that it can. We are now in a position to consider Parfit's *branch-line* case.

The 'branch-line' case: In this scenario the subject is teleported using updated scanners and replicators. The Earth based scanner malfunctions leaving the departing subject intact while a copy is reintegrated as normal at the Mars station. The original teleportee is told that the malfunction has also induced a heart condition and that his life expectancy is now no more than a few days. Should the original be worried?

Given what we have said regarding localisation of minds it is likely that the reaction would be one of shock and eventually melancholy, the only consolation being that there would be an identical copy to continue his life. Parfit uses this scenario to decide what is important, personal-identity-over-time (PIOT), or relation R with any cause (R). Here PIOT requires psychological continuity, where continuity has the right kind of cause, and there is no branching. For relation R we merely drop the no-branching condition. For Parfit it is relation R that is that matters, not PIOT (conclusion 4, p217) because he is arguing for an impersonal view of reality. He goes on to argue that, of his four conclusions, three (2-4) follow from conclusion 1 (p217), where the first sentence of conclusion 1 is

We are not separately existing entities, apart from our brains and bodies, and various interrelated physical and mental events. (Parfit, 1984, p216)

This is the main statement of conclusion 1. Like many physicalists it is likely that this conclusion is derived, at a deeper level, from the causal closure of physics (Papineau's premise 1). Despite this he does introspect and admits some doubt about is reductionist/physicalist conclusions. Further on, in an imaginary situation where he is just about to teleport himself, he quotes

But I expect that I would never completely lose my intuitive belief in the Non-Reductionist View. It is hard to be serenely confident in my Reductionist conclusions. (Parfit, 1984, p280)

One possible reason for this is that a small part of himself is aware of his own localisation (PL) and that he is living in an age where eternalism underlies the prevailing paradigm of physics. But because he appears wedded to physicalism it is not surprising that he arrives at the conclusions that he does.

Another quote from Parfit that seems very appropriate here is where he writes

I have conceded that the best-known versions of the Non-Reductionist View, which claims that we are Cartesian Egos, may make sense. And I have suggested that, if the facts had been very different, there might have been sufficient evidence to justify belief in this view. Some who believe in Cartesian Egos do not connect them, in such ways, to observable facts. (Parfit, 1984, p228)

Here Parfit leaves the door slightly open to a dualist position and concedes that it makes sense but then claims that there is insufficient evidence for it. In other words there is no evidence against it. From what has been said it seems that there is more than ample evidence for a dualist position. The observable fact that we only experience one point in time at any instant (PL) coupled with more than a century of modern physics supporting an eternalist theory of physical time entails the inescapable conclusion that minds and matter are distinct entities.

In hindsight, if you are a physicalist it is not difficult to see how Parfit arrives at the conclusion that relation R takes presidence over PIOT. After all, in both teleportation scenarios, the straightforward case and the branch-line case, there is still a surviving copy of the teleportee. If you are a dualist, however, you are constrained to treat both post-branch copies as separate individuals. I believe most people would regard it as sad that one of the branch line copies only has a few days to live. What consequences does PL have for Parfit's other examples?

Divided minds: Physicalists and reductionists frequently cite the *divided mind* scenario as empirical justification for their position. Here we claim exactly the opposite, the results of these surgical procedures fit in very nicely with the our dualists PL model. To summarise, the first paragraph of Parfit's section 87 reads

Some recent medical cases provide striking evidence in favour of the Reductionist View. Human beings have a lower brain and two upper hemispheres, which are connected by a bundle of fibres (the corpus callosum). *In treating a few people with severe epilepsy, surgeons have cut these fibres. The aim was to reduce the severity of epileptic fits, by confining their causes to a single hemisphere. This aim was achieved. But the operations had other unintended consequences. The effect, in the words of one surgeon, was the creation of 'two separate spheres of consciousness'.* (Parfit, 1984, p245)

In essence it was found that the left hemisphere received sensory input from sense organs on the right and controlled the right hand half of the body via motor function, the right hemisphere having a similar relationship with the left half of the body. During tests where the visual field was appropriately split it was found that the separate spheres of consciousness were completely unaware of each other, except maybe indirectly via other sensory input.

As previously implied, the relationship between bodies and minds is not one-to-one. There is always the possibility of many minds taking a path through one body – hence Albert and Loewer's position. To borrow Lewis' road analogy once again, we can think of the surgical procedure described above as a single one-way road suddenly becoming a dual carriageway, where the severed corpus callosum is represented by the central reservation. A nonmaterial mind will always be associated with one and only one hemisphere, and a mind confined to travelling the timeline of one hemisphere would always be unaware of the activity of the other.

The physics exam: We have just described the *fission* of a mind through a surgical procedure. What Parfit does next is another thought experiment where this procedure is reversible – *fusion*. For this he uses the imaginary scenario of a physics exam. As a candidate he is at the point of answering his last question with fifteen minutes remaining. He has a device implanted, which through manipulation of his eyebrows, allows him to shut off then re-establish communication across his corpus callosum. Realizing that there are two ways to answer this question, for ten minutes he divides his mind assigning the longer calculation to the left hemisphere, and the other to the right. In the remaining five minutes he reunites his mind. This is how he describes it

My work is now over. I am about to reunite my mind. What should I, in each stream, expect? Simply that I should suddenly seem to remember just having worked at two calculations, in working at each of which I was not aware of working at the other. This, I suggest, we can imagine. And, if my mind had been divided, my apparent memories would be correct. (Parfit, 1984, p247)

This makes perfect sense. I can imagine being one nonmaterial mind associated with one hemisphere only. Then when the corpus callosum is re-established. I would suddenly have all the memories from the other hemisphere available. And, assuming nonmaterial minds are unable to carry memories, it would not be possible for me to remember which hemisphere I had occupied. So the dualist model described here is completely consistent with Parfit's reductionist reasoning. We have reductionism applied to the physical world, which is the static structures of the brain. However, Parfit seems to have overlooked the simple experience of being at one point in time at each instant, and the fact that PL also implies that we can only occupy one hemisphere when the corpus callosum is severed. So what are the consequences for psychological branching?

The sleeping pill: Parfit describes the situation succinctly in the first paragraph describing this case

Certain actual pills cause retrograde amnesia. It can be true that, if I take such a pill, I shall remain awake for an hour, but after my night's sleep I shall have no memories of the second half of this hour. (Parfit, 1984, p287)

It is as though the half hour immediately before falling asleep is on a separate branch line, just like in the malfunctioning teleportation case. Parfit claims such similarity. Up to a point there are certain similarities, however, there are differences too. The main one is that there is no physical branching[5]. A nonmaterial mind still travels along one road, and there is no

[5] I am ignoring Everettian branching here.

immediate dead end like there is in the teleportation branch line. The main feature in this case is a modification to the way memories in the brain are addressed. Memories, especially recently acquired ones, are strongly ordered in a way that is monatonic to physical time. So I could remember event *A* three quarters of an hour before going to sleep, but not event *B* a quarter of an hour before. I also recall event *C* immediately after waking up. So the actual event ordering is *ABC*, whereas I only recall *AC*. The reason for this is because a physical structure in the brain, that would normally provide evidence that *B* took place, was disrupted as the drug took effect. These are nothing more than static features along the road that a nonmaterial mind travels.

Series-persons: Another non-branching scenario, proposed by T Nagel (Parfit, 1984, p290), is where, beyond the age of 30, every person is subject to an annual disintegration-reintegration cycle using a scanning replicator. This hypothetical solution to immortality effectively reverses the previous year's ageing while preserving the memories for that year. Essentially this is similar to the simple teleportation case described earlier. Again we cannot know whether a nonmaterial mind would remain associated with the brain state when it goes through stages of buffering and transmission. But if we make the same assumption as before, that it can, then this process is just a series of static features that a mind follows along this non-branching path.

Token or type: Here Parfit discusses Williams' considerations of a subject, Mary Smith, who undergoes a teleportation type process that disintegrates the original and materialises many copies. The copies are initially identical but as they continue their separate lives, their experiences, post-materialisation, will gradually diverge and they become increasingly individualised.

This is reminiscent of realistic Everettian branching. Applying PL, it is clear that the original Mary Smith will experience becoming one of the copies. But, to use Parfit's terminology, it is an empty question that enquires as to which copy the original will become. Considering Lewis' road analogy again, Parfit and Williams (Parfit, 1984, p293) only consider the branching road, not the travellers (note the plurality). Any one of the travellers, pre-branch, can legitimately call herself Mary Smith, and for each one there will be a probability associated with each copy she could potentially become. These probabilities are solely dependent on the physical aspects of the situation. That is, dependent on the properties of the road junction not the travellers. The important point here is that each mind is confined to one path. So once a mind arrives on one of the branches its life experience will include the pre-branch path and the branch it is currently on. The only difference between this situation and Everettian branching is that here the copies can communicate.

6. Summary

The apparent inconsistency between physical theories, as they have developed over the last century, and our experience of the world around us, has been a longstanding issue. The reason for this is because scientists and philosophers of science have, for the most part, adopted a physicalist approach to the problem. This is most manifest when Everett's interpretation of the quantum universe is invoked. All of the possible evolutionary paths for the universe as a whole actually exist, however, we only experience a fleeting glance of one classical branch during our lives. If we assume physicalism this conflict cannot be resolved,

because there is nothing to single out a focal point of consciousness. In physicalism we have a nice production of *Hamlet without the prince of Denmark.*

When we consider classical general relativity, this supports an eternalist's theory time, which considers that all events throughout space-time exist in a tenseless sense. At any instant of our experience, however, we are at one unique point in time. This is the principle of localisation (PL), which is directly inferred from our common experience (postulate *P II*). If we embrace a physicalist position then we need to explain how we experience phenomenal change. Modelling classical physics using eternalism (relativity) implies dualism but not free will. Free will is reinstated with the open branching structure implied by the Everett interpretation.

The strongest motivation for physicalism is likely to be the causal closure of physics, which was established during a period before the advent of relativity when neither presentism nor eternalism of time held sway. The prevailing physics coupled with the way our language is structured suggested the presentist's view as a natural way of thinking, from which we could trivially deduce PL

$$\text{Presentism} \Rightarrow \text{PL}.$$

Post relativity, eternalism became part of the new paradigm but our experience of localisation in time remained. Eternalism coupled with PL denies physicalism. The relevant logical relationships can be summarised as

$$\begin{aligned} \text{Postulate } P\,II &\Rightarrow \text{PL} \\ \text{Postulate } P\,I &\Rightarrow \text{Eternalism} \\ \text{PL} \wedge \text{Eternalism} &\Rightarrow \neg\text{Physicalism}. \end{aligned}$$

Our experience of change is a direct consequence of our movement between distinct points in C-space. But the elements that move cannot be of a material nature because the physical universe is, at root, timeless.

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