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Physical Time, Phenomenal Time, and the Symmetry of Nature

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Introduction

A stream of consciousness is a series of experiences whose adjacent members relate to one another as my present state of mind relates to the state of mind I was just in, rather than as my first mental state this morning related to my last mental state last night, or as my present state of mind relates to the state of mind that *you* were just in. The exact nature of this relationship is debatable; here, I am not offering an analysis of the concept of a stream of consciousness, but merely drawing attention to the phenomenon that I wish to discuss.

A typical human stream of consciousness extends over a period of hours, from one episode of dreamless sleep to the next. I wake up, eat breakfast, brush my teeth, take a shower, get dressed, walk to campus, check my e-mail, walk to the lecture theater, give a lecture, drink another cup of coffee, and check my e-mail again. I am conscious the whole time, and the experiences I have at each stage of my morning belong to a single stream of conscious experience.

But there is, for me, no such thing as an *experience* as of waking up, eating breakfast, brushing my teeth, taking a shower, getting dressed, walking to campus, checking my e-mail, walking to the lecture theater, giving a lecture, drinking a cup of coffee, and then checking my e-mail again. I have no experience characterized by both shower-taking and lecture-giving

phenomenology. The shower-taking qualia and the lecture-giving qualia all contribute to a single stream of consciousness, but not by contributing to a single experience—a single conscious state of mind.¹

Innocent as it seems, the fact that the experiences that make up a stream of consciousness do not all belong to a single, extended experience gives rise to a serious paradox. But to see how, we first have to inquire more closely into the way in which successive experiences in a stream of consciousness relate to one another.

Suppose you are standing before the mirror in your bathrobe, brushing your teeth, having the sort of experiences you normally do during this part of your morning routine, when suddenly you find yourself—or so it seems to you—chewing on a piece of beef jerky while riding horseback through a cactus forest. (Maybe your toothpaste is laced with LSD.) Overcoming your initial shock, you begin to suspect that you are dreaming, and decide to appreciate the desert landscape while it lasts.

Now let's modify the example. As before, you are brushing your teeth, and your conscious state of mind is what it usually is when doing so. This time, however, your tooth-brushing state of mind gets interrupted by a mental state phenomenally identical to the state of mind that Wyatt Earp was in on a certain October afternoon in 1881: same visual images of cactuses, same auditory sensations of jangling spurs, same cognitive and proprioceptive qualia, same "sense of self," and so on. The mental state is not characterized by any feeling of puzzlement or surprise, since no such feeling characterized Earp's state of mind on the afternoon in question.

The sequence of experiences just described is not a stream of consciousness. Rather, it is as if you had been suddenly annihilated and someone having a totally different kind of experience created in your place. The horseback-riding experiences occur immediately after the tooth-brushing experiences, and are even generated by the same brain as the tooth-brushing experiences, but they are not, for all that, co-streamal with the tooth-brushing experiences.

Why not?

The reason is that there is no *phenomenal overlap* between successive experiences in the second scenario, whereas there is such overlap in the first. Two experiences phenomenally overlap just in case one is completely characterizable (in terms of its phenomenality) as an experience as of a sequence of states or events $X \dots Y$, and the other completely characterizable as an experience as of a sequence $Y \dots Z$ (for some X , Y , and Z). When there is a phenomenal overlap between two experiences, the phenomenal content of one of the experiences is partially offset towards the future relative to the phenomenal content of the other experience.

Let us call any series of experiences all of whose adjacent members phenomenally overlap a phenomenally integrated series. The experiences

that you have in the first scenario, but not the second, form a phenomenally integrated series. In both scenarios, you begin with an experience of moving your toothbrush right then left. But in the second scenario, this experience is followed—not by an experience as of moving your brush left then chomping on jerky, but—by an experience that exhibits no toothbrush-related phenomenology at all. In the second scenario, there is no *Z* such that you have (1) an experience as of brush-right then brush-left, and (2) an experience as of brush-left then *Z*. There is no experience in this scenario that possesses both tooth-brushing and horseback-riding qualia: none of the tooth-brushing states of mind contains any hint of horseback riding, and none of the horseback-riding mental states contains any trace of tooth-brushing. That is why it is, phenomenologically, as if someone brushing his teeth had been annihilated and someone riding a horse created in his place.²

A paradox

The fact that phenomenal integration is necessary for co-streamality poses a challenge to attempts to account for the stream of consciousness in a phenomenologically realistic way. Suppose that I am listening to someone play scales on the piano, and suppose (somewhat unrealistically) that the only conscious experiences I have while listening are auditory experiences of the various notes being struck. Naively, we might try to represent my stream of consciousness in this situation as follows:

(1) (*Do, Re, Mi, Fa, So, La, Ti*)

—where “*Do*” designates an experience as of the note C being struck, “*Re*” an experience as of D being struck, and so on. This representation is naive, because it does not capture the phenomenal integration of the series of experiences it attempts to represent. (1) might equally well represent the series of experiences I would have if I was first in a mental state indistinguishable from that of someone who hears only a solitary C, and then in a mental state indistinguishable from that of someone who hears only a solitary D, and then in a mental state indistinguishable from someone who hears only a solitary E, and so on.

A seemingly natural fix is to represent my auditory stream of consciousness like this instead:

(2) (*Do...Re, Mi...Fa, So...La, Ti*)

—where “*Do ... Re*” represents an experience of C followed by D, “*Mi ... Fa*” an experience of E followed by F, and so on. But this will not do either. For while it is true that my stream included an experience of C followed by D as well as an experience of E followed by F, it *also* included an experience of D followed by E; but this latter experience goes unrepresented here.

Very well then: let’s just insert a new element into the series, to represent the D-followed-by-E experience (as well as the other, similar experiences that (2) omits):

(3) (*Do...Re, Re...Mi, Mi...Fa, Fa...So, So...La, La...Ti*)

Problem solved?

No. What we have now represented is not the stream of conscious experience that I had while listening to the scales, but the stream that I would have had if I had heard someone play the following sequence of notes: CDDEEFFGGAAB.

In fact, (3) doesn’t even succeed in representing *that* (counterfactual) stream! This is for the same reason as (1) fails to represent my actual stream: (3) fails to capture the phenomenal integration of the series of experiences I would have if I heard someone playing the “stutter” scale. To get an adequate representation of the stutter-scale stream, we could try:

(4) (*Do...Re, Re...Re, Re...Mi, Mi...Mi, Mi...Fa, Fa...Fa, Fa...So, So...So, So...La, La...La..., La...Ti*)

It’s clear where this is going. In order for the experiences I have while hearing the scales to belong to a single a stream of consciousness, they must constitute a phenomenally integrated series. But in order to constitute a phenomenally integrated series, it seems my experiences must include many that I simply do not have—and even if we suppose that I *did* have such experiences, we *still* wouldn’t have a stream of consciousness, without positing yet further experiences, *ad infinitum*.

Of course it would be different if, while listening to the scales, I had just a single, lengthy experience: an experience as of C followed by D followed by E followed by F followed by G followed by A followed by B. But I had no such experience. (Or, if I did, we need only consider a longer stretch of time over which I listen to the player play the scales repeatedly, perhaps for an hour.)

And so we have a paradox. In order for our experiences to occur as parts of (lengthy) streams of consciousness, our experiences must be phenomenally integrated, without collectively constituting a single (lengthy) experience. But when we try to describe a stream of consciousness in a way that respects these constraints, we end up badly misdescribing it as including many experiences that it does not, in fact, include.

This is what Barry Dainton calls the problem of repeated contents. The problem is as important in its own way as the famous Eleatic paradoxes of motion and change. There is even a structural similarity between the paradoxes. What generates the Arrow Paradox, for example, is the seeming need for the arrow to traverse infinitely many intervals of time and space in order to make any progress along its path. What generates the paradox of the stream of consciousness is the seeming need for the mind to traverse infinitely many experiences in order to make any progress through its stream of consciousness.³

Grappling with Zeno's paradoxes has led to valuable insights into the nature of time, space, and the infinite. As we shall see, grappling with the paradox of the stream of consciousness stands to yield valuable clues to the relationship between spacetime and experience.

Dainton's theory

Dainton solves the problem of repeated contents by supposing that the pairwise phenomenally overlapping experiences that make up a stream of consciousness also overlap in the literal sense that they have experiential parts in common. For example, according to Dainton, my *Do ... Re* experience has two briefer experiences as parts: (a) an auditory experience as of C, and (b) a slightly later auditory experience as of D. Similarly, my *Re ... Mi* experience comprises (c) an experience as of note D being played, and (d) a slightly later experience as of E being played. But—and this is the key idea behind Dainton's theory—experience (b) is one and the same experience as experience (c). So the *Do ... Re* experience and the *Re ... Mi* experience have between them only three basic constituents: an auditory "Do" experience, an auditory "Re" experience, and an auditory "Mi" experience. Since I do not, by this account, have two experiences as of "Re," the account escapes the problem of repeated contents.⁴

Dainton's solution to the problem of repeated contents relies on the idea that some of our experiences are extended in time, consisting of successive, briefer, and (ultimately) temporally basic experiences none of which have successive experiences as parts. In Dainton's terms, a stream of consciousness consists of overlapping sequences of "diachronically co-conscious" experiences, diachronic co-consciousness being the relation by virtue of standing in which a number of successive experiences constitute a longer, complex experience.⁵

Dainton's proposal conflicts with what Dainton (following Izchak Miller) calls "the Principle of Simultaneous Awareness" or PSA. This is the view that

each of our conscious experiences is temporally basic, and in fact strictly momentary, having no objective duration whatsoever.⁶

While the PSA has a certain initial plausibility, there are, Dainton argues, no obviously compelling reasons to accept it. A less extreme view is that *some*, but not necessarily all, of our conscious experiences, including presumably our simplest or most basic experiences, are as the PSA says (perhaps erroneously) all experiences are. It may be that consciousness is wholly present at some moments of my waking life, but that I also have extended experiences comprising the contents of successive waking moments. This position is consistent both with the PSA and with the existence of diachronically co-conscious experiences.⁷

I believe that this more moderate view—that our temporally basic experiences have no objective temporal extent—is true, and that its truth has unexpected implications for Dainton’s theory of the stream of consciousness.⁸

From here I proceed as follows. In the next section, I give an argument (based on some remarks from Bertrand Russell) in support of the more moderate view described above, which I shall call Russell’s Thesis. In the section after that I anticipate and address the main objection to this argument. I will follow this by arguing that Russell’s Thesis, when combined with Dainton’s theory of the stream of consciousness, entails a violation of an otherwise universally observed symmetry of nature connected with the so-called reversibility of fundamental natural laws.

Russell’s Thesis

In a paper from 1914, Russell writes:

Two events which are simultaneous in my experience may be spatially separate in psychical space, e.g. when I see two stars at once. But in physical space these two events are not separated, and indeed they occur in the same place in space-time. Thus in this respect relativity theory has complicated the relation between perception and physics.⁹

Here Russell claims that the phenomenal events that characterize any moment of one’s conscious mental life are confined to a single point of spacetime; let us call this Russell’s Thesis.

While Russell’s argument for the thesis is not entirely explicit, it clearly has something to do with the relativistic structure of spacetime. In a relativistic context, if it is possible correctly to describe a given pair of events as occurring simultaneously at some distance from one another (in terms of a given inertial

coordinate system or “frame of reference”), it is also possible to describe those events as occurring in temporal succession (in terms of a different but equally good frame of reference). This is in contrast to classical Newtonian physics, in which two spatially separated events are simultaneous in terms of one frame of reference only if they are simultaneous in terms of *every* frame of reference. We can put this by saying that simultaneity is “absolute” in a Newtonian context, but not, except in special cases, in a relativistic context. In relativistic spacetime, two events occur absolutely simultaneously (i.e. are assigned identical time coordinates by every inertial coordinate system) only if they occur not only at the same point in time, but at the same point in space. I reconstruct Russell’s argument for his thesis as follows:

- R1. If consciousness is in spacetime, each of my temporally basic experiences instantiates its qualia absolutely simultaneously.
- R2. Properties that get instantiated absolutely simultaneously get instantiated at the same point of spacetime.
- R3. So, if consciousness is in spacetime, each of my temporally basic experiences instantiates its qualia at a single point of spacetime. (R1, R2)
- R4. Any experience that instantiates its qualia at a single point of spacetime is a point-event (an event confined to a single point of spacetime).
- R5. So, if consciousness is in spacetime, each of my temporally basic experiences is a point-event. (R3, R4)

Let us call this the Relativistic Argument. Russell seems to regard its first premise as evident from introspection. There is certainly something to this. When I look at a banana, I have a conscious experience that is simultaneously characterized by a certain phenomenal shape, a certain phenomenal size, and a certain phenomenal color. My experience’s simultaneous possession of these phenomenal properties is moreover *absolute*, in the sense that the experience instantiates the properties simultaneously according to every complete and accurate description of the world. If you were to describe me as having first an experience as of the bananas’s shape, followed by an experience as of its size, and only then an experience as of its color, you would badly misdescribe my experience of the banana.

R2 says that absolutely simultaneous property instantiations are confined to a single point of spacetime. As Russell points out, this is a direct consequence of the fact that in relativistic spacetime, absolute simultaneity entails spatial and temporal co-location.

There are two ways you might try to dispute this fact (short of denying the relativistic structure of spacetime). First, you might argue that conscious

experience occurs in physical time, but not in physical space, and therefore not in spacetime (and not, *a fortiori*, in relativistic spacetime). (By “physical time” I mean the time in which physical events take place; it may be that there are non-physical events that occur in physical time.)

But an event (whether an experience or anything else) cannot occur in physical time except by occurring in physical spacetime. A description of events purely in terms of physical time is an underdescription of events, not only because it does not tell us how the events relate to one another in space, but also (and partly because of this) because it does not tell us which events occur *absolutely* before, after, or simultaneously with which others. The statement that event E_1 occurs at the same time as event E_2 does not convey whether the simultaneity of E_1 and E_2 is absolute or merely relative; for that, we need to know whether E_1 and E_2 occurred at the same place (in addition to the same time).

A description of physical events in purely temporal terms therefore fails to specify any absolute temporal structure for those events. To say that experiences occur in physical time but not in physical space would therefore be to claim, implicitly, that there was no fact of the matter concerning the temporal relationships between our conscious experiences and ordinary physical events. But this would be as much as to say that conscious experience does not occur in physical time at all.

A different objection to R2 is that conscious experiences might occur in physical spacetime, but in a non-relativistic way. Granted that our experiences occur in spacetime along with physical events, why should we think that the relativistic conception of spacetime applies to our experiences?

But if phenomenal events occur in the same spacetime as physical events, it must be possible for a phenomenal event to coincide with a physical event. This is particularly so in view of the fact that physical events occur throughout spacetime (e.g. as components of the cosmic microwave background). Consider two spatially separated, and supposedly absolutely simultaneous, phenomenal events, A1 and A2, and a pair of physical events, B1 and B2, with which the phenomenal events respectively coincide. Then A1 is absolutely simultaneous with B1, and A2 with B2. But then it must also be the case that B1 is absolutely simultaneous with B2, since A1 is absolutely simultaneous with A2, and absolute simultaneity is transitive.

The upshot is that if spatially separated phenomenal events can be absolutely simultaneous, spatially separated *physical* events can be absolutely simultaneous too. Since separate physical events cannot be absolutely simultaneous, neither can separate phenomenal events.

The final premise of the Relativistic Argument (R4) states that any co-instantiation of qualia at a point in spacetime is a conscious experience. This is just an *a priori* truth about consciousness. It can be expressed as a

conditional: if some qualia are co-instantiated at a point in spacetime (or by the contents of a point in spacetime), then that point contains conscious experience. One should accept this conditional, even if one rejects its antecedent.

The now of experience

If the Relativistic Argument has a vulnerability, it is R1: the claim that a temporally basic experience instantiates its qualia absolutely simultaneously (assuming that temporally basic experiences occur in time).

One cannot very well object to R1 that a temporally basic experience might instantiate some (or all) of its qualia in temporal succession. Any experience that instantiates qualia successively is, *de facto*, not temporally basic, since it has non-simultaneous experiences as parts or phases (corresponding to the successive qualia instantiations).

The more serious objection to R1 is that it relies on a dichotomy, allegedly false, between (1) some qualia getting instantiated in temporal succession, and (2) those qualia getting instantiated absolutely simultaneously (and so at a single point of spacetime). There is, one might claim, a third option: (3) the qualia get instantiated by the same *objective temporal sequence* of point-events, not by successive point-events, and not by a single, solitary point-event.

Call option (3) *serialism*. A serialist disputes R1 on the grounds that every experience is a temporal sequence of intrinsically non-experiential events. He claims that the instantiators of qualia are not point-events or the contents of individual moments of time, but whole temporal series of point-events.

Serialism is antithetical to what I would like to call the Presence Principle. This is the principle (tacitly assumed by Russell in his discussion) that in order for consciousness to exist in time (or spacetime), there must be moments (at least one moment) whose contents are sufficient for conscious experience—that is, whose contents are such that there is something that it's like for someone, or something, for those contents to exist. According to the Presence Principle, consciousness is sometimes (indeed, often) wholly present; according to serialism, consciousness is never wholly present. Which is right?

A gladiator lies in the dust. He has, let us suppose, a conscious visual experience as of the Colosseum: the flying banners, the jeering throng, the Emperor's wavering thumb. Call this experience *V*. According to the serialist, *V* is an instantiation of qualia by some objective temporal sequence of

non-experiential events, say e_1 , e_2 , and e_3 . But what, according to the serialist, is the gladiator's state of mind shortly before e_3 occurs—say, when e_2 takes place?

Suppose that the gladiator had died at e_2 , or between between e_2 and e_3 . Would he have had V ? Not according to the serialist: according to him, the e_1 - e_2 - e_3 event-sequence is what instantiates the qualia that characterize V (if anything does). But this event-sequence does not exist in a hypothetical scenario in which the gladiator does not live long enough for e_3 to occur. So, the serialist has to say that the gladiator does not, in that hypothetical scenario, have V , and therefore does not have the same quantity and quality of conscious experience as the actual gladiator (who makes it past e_3 and who does have V).

But now suppose that at or around the time that e_2 takes place, but before e_3 , the gladiator poses himself the question: *Am I having V?*—or, as he might more naturally put it: Am I having *this* experience? How should he answer himself? Assuming that e_3 does eventually occur, he does have V . But when he asks himself whether he is having V , he might have reason to believe that e_3 will not occur (he knows the Emperor has always given the thumbs-down in the past). On this basis, he will judge that he is not having V —he will judge that he is not having the experience, even though he is having the experience.

This is odd. But the serialist may argue that in reality, there is not enough time between e_2 and e_3 —or for that matter within the whole $[e_1, e_3]$ interval—for the gladiator to pose himself any question, or perform any other mental act. Our thought processes unfold at a slower pace than our conscious visual processes, and this prevents us from ever getting into the dubious cognitive condition attributed to the gladiator in the preceding paragraph.

But even if evolution has not equipped us with cognitive machinery fast enough to form thoughts between the successive events that constitute an experience (on the serialist view), it might have done so; or, if not, we might bring our cognitive machinery up to speed by artificial means.

Suppose that the gladiator's cognitive capacities are greatly enhanced. Suppose that his cognitive centers gain high-bandwidth access to real-time information about the low-level states of his perceptual centers. And suppose that he benefits from cognitive enhancements that allow him to process this information as it streams in. His experience-producing perceptual centers themselves are left alone.

This fast-thinking gladiator *can* make deliberate judgments between e_2 and e_3 . So what does he judge then? Presumably this depends on what information he has. But if he has information implying that it is unlikely that e_3 will occur, then, if he is rational, he must (assuming the truth of serialism) judge that he is *not* having V , even though he is.

One might insist that all this cognitive enhancement (high-bandwidth access to microphysical brain-activity, high-speed information processing

capabilities, and so on) would have phenomenological repercussions. That is probably right; at least, one would expect the cognitive enhancement to come with some novel cognitive phenomenology, and possibly novel perceptual or proprioceptive phenomenology too. But this additional phenomenology need not prevent the gladiator from having the conscious experiences he would have had without the enhancement, or experiences much like them. For example, it need not prevent the gladiator from having more or less ordinary visual experience.

Serialism therefore appears to entail that it is possible to become rationally less confident that you are having conscious experience, or a given kind of conscious experience, just by acquiring additional information about a conscious experience that you are, in fact, having. But this is unacceptable. *Gaining more information about a conscious experience that you are having cannot make you rationally less confident that you are having a conscious experience of that kind.* The fundamental argument for the Presence Principle (and against serialism), and the linchpin of the case for Russell's Thesis, is that if you reject the Principle, you must say, wrongly, that one can become rationally less confident that one is having (say) visual experience, just by gaining more information about some visual experience that one is, in fact, having.

The law of experience

Our conscious mental lives are teeming with a huge variety of experiences. But within this teeming variety we can discern a considerable amount of order. By and large, it is possible to interpret our experiences as perceptions of a universe of objects behaving, and events unfolding, in accordance with certain laws—the laws of physics.

The possibility of interpreting our experiences this way is more obvious in the case of some laws than in others. We can hardly help interpreting our experiences as including perceptions of spatiotemporal continuants. If we think of the existence of such continuants as a law of nature, we can say that our experiences are obviously interpretable as perceptions of a world that conforms to this law.

Our experiences are also interpretable as perceptions of a world that conforms to the Einstein Field Equations. The possibility of interpreting them thus is far less obvious—otherwise, it would not have taken people so long to interpret them that way.

Between these two extremes, we have the possibility of interpreting our experiences as perceptions of a world in which an object's resistance to

change in its state of motion upon application of some force is independent of where, when, or in what direction the force is applied. And there are many other intermediate cases as well, some closer to the law of continuants, some closer to the Field Equations.

Not all experiences are interpretable as conforming to all, or perhaps even to any, of these laws. Pathological experiences are possible, which, considered in isolation, resist interpretation as perceptions of any lawlike state of affairs. Still, taken all together as a collective whole, our experiences do admit of interpretation as perceptions of a world that conforms to such laws as those mentioned above.

We can think of this property of human experiences as corresponding to a law in its own right, a "law of experience." Our experiences conform to this law by tending to occur in such a way as to admit of interpretation as perceptions of a universe that conforms to those other laws.

The law of experience is undoubtedly a law. But is it a *fundamental* law? It is hard to see how it could not be, unless phenomenological states of affairs reduce to purely physical states of affairs. If dualism is true, the law of experience is bound to be fundamental (even if it correlates with some purely physical law or laws), and if phenomenalism is true, the law of experience is likely to be not just fundamental but architectonically central. But if physicalism is true, then presumably the order we find in our conscious experience is not fundamental, but reduces to some purely physical feature of the world.

Like Dainton, I am deeply skeptical of physicalism. I will not rehearse the well-known arguments against physicalism here, but only point out that Russell's Thesis poses an additional problem for the physicalist position.¹⁰

In a traditional conceptual setting, where we think of time and its determinations as absolute, the physicalist would naturally identify temporally basic experiences with complexes of simultaneous physical events—say, neuron-scale events occurring simultaneously within a human brain. From here, he might build up to more complex experiences, but at the most basic level, one would normally expect a physicalistic experience to consist of a collection of simultaneous physical events distributed throughout some spatially extended network.

But if Russell's Thesis is correct, then many of our most basic experiences are mere point-events. The traditional physicalist picture is therefore untenable. (I take it that this is why Russell says that "relativity theory complicates the relation between perception and physics.")

A physicalist might argue for an identification of temporally basic experiences with individual physical point-events. The connection of these individual point-events to larger-scale physiological activity would have to be spelled out, but as long as there is some exceptionless correlation between a given kind of physical point-event and a given kind of phenomenally-individuated

temporally basic experience, there is a basis (a physicalist might argue) for equating the two.

However, this proposal requires us to accept that the world contains far more experience than we ordinarily suppose. Any physical point-event that occurs in the body of a sentient being can also occur outside of any such body. What is distinctive about, for example, a human body, is not that it is made up of distinctive sub-atomic events, but that the sub-atomic events that constitute it relate to one another so as to form distinctive physical states and processes extended in time and space. So if we are to identify various experiences with physical point-events, we will have to identify them with events that occur, or could occur, in rocks, plants, sausages, and other *prima facie* unconscious things.

Furthermore, it is likely that for every sub-atomic physical event that occurs in the body of a bat (or any other creature), there occurs an exactly similar sub-atomic event in my body. Here, the implication of the physicalist's proposal is that there occur in my body the same kinds of temporally basic experiences as occur in the bodies of bats and other conscious animals.¹¹

The appeal of physicalism was always its promise to make sense of consciousness as something that explains various aspects of our behavior, by construing conscious mental states as mediators of environmental input and behavioral output. A theory that attributes consciousness to sausages cannot possibly deliver on this promise.

Setting aside physicalism, it seems appropriate to regard the law of experience as a fundamental law, like the fundamental laws of physics.

Now, the fundamental laws of physics all exhibit a certain symmetry. In classical Newtonian physics, the fundamental laws of motion are time-reversal invariant, in the sense that they would also hold good in a time-reversed counterpart of our world, in which events occurred in the opposite temporal order from that in which they actually occur, and with opposite time-dependent properties from those which they actually possess.

The situation is different, but similar, in contemporary physics. There are, it turns out, physical processes governed by laws that are *not* time-reversal invariant. A time-reversed counterpart of our universe would not conform to all the fundamental laws that govern our (actual) universe, since it would violate the fundamental laws that determine the probabilities for various forms of elementary particle decay.¹²

Nevertheless, the fundamental laws are invariant under a more inclusive reversal of time, spatial position, and charge. In other words, even though a merely time-reversed counterpart of our universe would violate certain fundamental laws, a counterpart of our universe that was reversed with respect to time (as described earlier), space (as in a mirror reflection), and charge (with positive charges replacing negative charges and vice versa) *would* obey the same fundamental laws as the actual world obeys.

In so far as our universe is governed by the fundamental laws of physics, it is symmetrical in this way; the fundamental laws of physics are CPT-reversal invariant. What about the law of experience?

If, as Dainton contends, our streams of consciousness consist of diachronically complex experiences (comprising simpler diachronically co-conscious experiences), the law of experience is *not* CPT-reversal invariant. The reasons for this are as follows.

Let us call the CPT-reversed counterpart of the actual world “Unworld.” Unworld contains all the same temporally basic experiences as the actual world, since each of these experiences is a mere point-event. If there actually occurs a temporally basic experience as of a bird gliding from left to right, then the same experience occurs in Unworld.

The situation would be different if temporally basic experiences were, as the serialist maintains, temporally extended sequences of non-experiential events; in that case, one could argue that a reversal in the temporal order of those non-experiential events would involve a corresponding reversal of the phenomenology of the experience that those events constituted. But if, as Russell’s Thesis states, temporally basic experiences are confined to individual points of spacetime, they have no temporal structure to reverse.

Now, in Unworld, our temporally basic experiences occur in the opposite temporal order from that in which they actually occur in us. Suppose I am watching a pendulum. And suppose that while watching, I have, among others, a diachronically complex experience as of the pendulum moving from A to B to C to B to A. This experience, we may assume, consists of four temporally basic appearances: (1) an appearance of the pendulum swinging from A to B, (2) an appearance of the pendulum swinging from B to C, (3) an appearance of the pendulum swinging from C to B, and (4) an appearance of the pendulum swinging from B to A (see Figure 7.1).

In Unworld, the temporal order of these four experiences is reversed. Therefore, if I have a diachronically complex experience consisting of them, it is an experience as of the pendulum moving first from B to A, then from C to B, then from B to C, then from A to B.

Such an experience, considered by itself, might not be an experience as of a physically impossible sequence of events. One could imagine that the particles making up the pendulum decohere and recombine in astronomically unlikely, but physically possible, ways. But in Unworld, *all* diachronically complex experiences—which means very many of the Unworlders’ experiences—are like the bizarre pendular experience just described. If, in the actual world, I have a diachronically complex experience as of a ball rolling down an inclined plane from point G through point H to point I—an experience consisting of two temporally basic experiences (as of the ball rolling from G to H, and as of the ball rolling from H to I), my counterpart in Unworld has

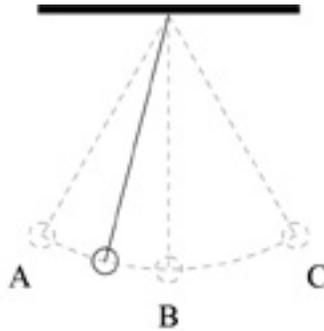


FIGURE 7.1

an experience as of the ball rolling from H to I and then—without any intermission—from G to H.

Considered as a whole, the Unworld experiences do not admit of interpretation as perceptions of a world of physical things conforming to the laws of physics. As the foregoing examples illustrate, this includes even very simple laws, such as those dictating that physical objects enjoy spatiotemporally continuous existences.

Of course, Unworld does obey the laws of physics. In Unworld, pendula, balls, and all other things obey fundamental physical laws. But if, as Dainton's theory requires, our streams of consciousness consist of sequences of overlapping temporally extended experiences having successive temporally basic experiences as constituents, Unworld does not conform to the law of experience. Dainton must therefore regard the law of experience as a fundamental law of nature that, unlike other fundamental laws, violates CPT-reversal invariance.

Conclusion

I conclude that while Dainton's theory of the stream of consciousness is consistent with Russell's Thesis (that our temporally basic experiences are wholly present at individual points of spacetime), it combines with Russell's Thesis to violate an otherwise universally observed symmetry of nature.

One response would be to conclude that CPT-reversal invariance is not, after all, *sine qua non* for fundamental lawhood. It's not as if this sort of thing hasn't happened before. People used to think that all fundamental laws were time-reversal invariant. Dainton might reason that since experiences must occur in time, and since the only way they can do so without impossible phenomenal repetition is by occurring as his theory describes, and since,

finally, his theory implies a violation of CPT-reversal invariance, we *must* conclude that CPT-reversal invariance is violated.

On the other hand, if we want to say that the stream of consciousness unfolds in objective, physical time without violating CPT-reversal invariance, we have no alternative but to affirm the Principle of Simultaneous Awareness. If *all* of our experiences are temporally basic, then there need be no violation of time- or CPT-reversal invariance. We need only suppose that the objective order of experiences in a stream of consciousness is phenomenologically meaningless. And this is not an obviously unreasonable thing to say. For surely the really remarkable thing about conscious experience, apart from its very existence, is that it is possible to interpret the totality of it as comprising, by and large, perceptions of a common, intelligible world of events in time and space.

The idea that the objective temporal order of the experiences in a stream of consciousness has no phenomenal implications may seem strange, or even absurd. But here we should remember that we never introspect more than one experience in a single act of introspection, unless it is by introspecting multiple experiences that occur as phenomenal constituents of a single, complex experience. The basic point is due to Susan Hurley. If I can introspect multiple experiences in a single act of introspection, those experiences must belong to a single experience. What would it be like, for introspection to reveal to me that I had two experiences that did not belong to the same state of consciousness? The answer is that there can be nothing that this is like. For, if there *were* something it was like, then the introspected experiences would belong to a single experience: an experience by virtue of having which there was something it was like for me to introspect myself as having the two experiences.¹³

Unfortunately, the suggestion that all experiences are temporally basic takes us back to square one with the stream of consciousness, since you can't construct a Daintonian stream with temporally basic experiences alone, and Daintonian streams are the only ones described so far that avoid the problem of repeated contents. A more radical way to preserve CPT-reversal invariance that does not lead back to the problem of repeated contents would be to suppose that conscious experiences do not occur in time, or spacetime, at all, but function more like an atemporal subvenient base for physical reality (the reality of things in physical time and space). After all, if the temporal order of our experiences is phenomenologically meaningless, why suppose that they have any temporal order at all? And if experiences do not even exist in time, then repeated contents are impossible *ab initio*. Of course, it is far from obvious that a timeless conception of experience ultimately makes sense; this is a question too large to pursue here.

Dainton's theory of the stream of consciousness has the great virtue of solving the problem of repeated contents, being apparently the only theory, among those that construe experiences as occurring in physical time, to do so. The upshot of the present discussion is that the solution does not come for free. Diachronic co-consciousness is not a minor technical innovation, but a weighty metaphysical posit that requires us to see consciousness as extending through time differently from all other temporal phenomena. How this figures into the ultimate cost-benefit analysis of Dainton's theory remains, I think, uncertain, depending on large questions about the more general relationship between time and consciousness. But whichever way the balance of considerations finally tips, it is Dainton who gets the credit for showing us how to work the scales.

Notes

- 1 The word "experience" has many meanings, and it might be that in one of them, the statement that all my day's sensations belong to a single experience comes out true; presumably Michael Tye is using the word in some such sense when he claims that all of the experiences in a stream of consciousness belong to a single, temporally extended experience (Tye 2003: 108). In any event, it is, I take it, uncontroversial that the qualia that characterize the various phases of an afternoon of conscious mental life do not characterize a single "experience" in the same sense as that in which the various qualia that characterize each phase individually do so, and it is this latter sense of "experience" that is relevant to our purposes here (see Dainton 2008: 71–3).
- 2 Phenomenal integration is necessary, but not sufficient, for co-streamality. If I have a stream of consciousness consisting of successive experiences $I_1, I_2, I_3, \dots, I_n$, and my counterpart on Twin Earth has a phenomenologically indistinguishable stream consisting of experiences $T_1, T_2, T_3, \dots, T_n$, then the series $I_1, T_2, I_3, T_4, \dots, I_{n-1}, T_n$ is phenomenally integrated, but it isn't a stream of consciousness.
- 3 See Dainton (2006: 141–2, 156–9).
- 4 See Dainton (2006: 162–77).
- 5 Might *all* conscious experiences consist of briefer successive experiences? That is, might consciousness consist of temporally extended phenomenal "gunk"? Elsewhere I argue not; here, I simply assume that human experience has a logically atomic structure.
- 6 See Dainton (2006: 131–5). Past proponents of the PSA include, apparently, St. Augustine, William James, C. D. Broad, Edmund Husserl, and Michael Lockwood.
- 7 For critical discussion of the PSA, see Dainton (2006: 162–6, 179–82).
- 8 By a "temporally basic experience," I mean an experience that doesn't have non-simultaneous experiences as parts.

- 9 Russell (1914: 130).
- 10 For classic arguments against physicalism, see Chapter 2 of Broad (1925), Campbell (1970: 100–1), Jackson (1982), and Chalmers (1996: 93–140). For Dainton’s skepticism, see Dainton (2006: 5–10).
- 11 It is also not obvious that there is enough variety among physical point-events to reflect the phenomenal variety of temporally basic experiences. This is connected with the so-called “grain problem”: see Lockwood (1993: 275–6).
- 12 The experiments that originally established the violation of time-reversal invariance are described in Lee and Yang (1956) and Christenson et al. (1964).
- 13 See Hurley (1998: 164–5), and for relevant discussion, Bayne and Chalmers (2010: 510–11, 527–9).

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