

Article

Personal Time and Transmigration Time Travel

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Abstract: Lewis argued that although paradoxes such as the famous Grandfather Paradox can be solved, only a limited set of time travel fiction is consistent. In this paper, I discuss how to extend a Lewisian approach to a class of time travel fiction not considered by Lewis: transmigration or mental time travel fiction. To this end, Lewis's definition of personal time needs refining, and this is the primary focus of my paper. I discuss some alternative refinements of Lewis's definition: a Solely Mental definition and a Causal definition. I end by also applying these definitions to cases of reverse aging.

Keywords: time travel; personal time; personal identity

1. Introduction

The focus of this paper is Lewis's definition of personal time, and the challenge of refining this to capture cases of transmigration time travel.

Transmigration time travel is a genre of fiction that involves a time traveler's mind, soul, or consciousness traveling without any part of their body. There are plenty of examples of time travel fiction of this sort: it is the basis for a popular genre of science fiction that we can call transmigration time travel or mental time travel.¹ This includes cult TV series like *Quantum Leap* [2] and *Travelers* [3], and movies like *Hot Tub Time Machine* [4].

A beautifully simple example of transmigration time travel is mentioned by John Perry in the preface to his book *Knowledge, Possibility and Consciousness* [5] (preface) (He attributes this idea to his brother Tom):

"When we were both in our early teenage years Tom came up with the theory that there was only one soul in the universe, which travelled backward in time each time a person died and was recycled as some other person's soul. . . Finally he convinced me that this was the most minimal and economical form of dualism."

This story involves the existence of an immaterial soul, so it assumes substance dualism. However, this does not mean that it will be of no interest to physicalists. After all, many physicalists believe that substance dualism is only contingently false and will accept that if a time travel scenario is consistent with a dualistic version of Lewisian time travel, then that time travel scenario is metaphysically possible *tout court*.

Other transmigration time travel stories do not require substance dualism. For example, the *Travelers* TV series [3] talks of a time traveler's mind transferring to a host body by overwriting the host brain, which presupposes a physicalist view of the mind. Another way a physicalist would accept of transferring a mind from one body to another would be via a brain transplant, but in this paper, I focus on cases where the time traveler's mind, soul, or consciousness travels without any part of their body.

Lewis's definition of personal time is the basis of his framework for time travel. Attempting to apply a Lewisian framework to transmigration time travel fiction will show that Lewis's definition of personal time needs modifying. This is not just a matter of the correct interpretation of Lewis's definition of personal time. I consider different interpretations of Lewis's definition of personal time: the Wristwatch definition, the Counterfactual Wristwatch definition, the Functional definition, and a Corrected Functional definition,



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and show that none of these are suitable for analyzing transmigration time travel. The Wristwatch definition and the Counterfactual definition are unsuitable due to the problem of attaching a wristwatch to a mind, soul, or consciousness. The Functional definition and Corrected Functional definition involve physical regularities as well as mental regularities, and so they are also unsuitable for analyzing transmigration time travel.

I then suggest two alternative modifications of Lewis's definition of personal time: a Solely Mental Functional definition and a Causal definition. As we shall see, these are both successful in analyzing cases of transmigration time travel fiction, though each has some limitations.

2. Transmigration and Transmigration Time Travel Fiction

"Americans are deeply familiar with the classic time-travel trope. . . But most Chinese and Korean dramas approach time travel completely differently. Instead of having protagonists travel back and forth in time, these works use a concept known as transmigration which combines soul migration with time travel." [6]

Transmigration time travel combines the concept of *time travel* with the concept of *transmigration*: a soul, mind, or consciousness migrating to another body, or to a different temporal stage of the same body.

By adding another element to classic time travel, transmigration time travel may seem much more complex. However, transmigration is a very familiar and natural idea to many people. A belief in the transmigration of the soul or consciousness after death has been held in many forms since ancient times. Reincarnation is the belief in the natural process of transmigration of the soul or consciousness to a different body after death, though in most cultures, reincarnation does not involve time travel (as you cannot be reincarnated as a past person, and reincarnation is normally thought to be immediate after death). Beliefs about reincarnation have a long and complicated history—they are part of the Hindu and Buddhist religions as well as being part of many present-day indigenous cultures and ancient cultures. Survival of the soul after death is also present in Christianity, Islam, and Judaism: according to these Abrahamic religions, the soul survives the death of the body, though standardly this is understood as disembodied survival in an afterlife.²

It will be helpful to classify transmigration time travel fiction by whether the time travel involves one body or multiple bodies, and by the metaphysical presuppositions of the transmigration. First, we will consider whether the time travel involves one body or multiple bodies:

- (1) Same Body: A mind, soul, or consciousness travels in time within different temporal stages of the same body. Examples of this are the movies *13 going on 30* [7] and *Hot Tub Time Machine* [4]. In some variations, the body may be left without a soul or consciousness during some periods of time. For example, in the movie *Click* [8], the protagonist's consciousness makes frequent jumps forward in time to his own future body, with the jumps controlled by a universal remote controller. In between these jumps are periods of time in which his body is on auto-pilot and he is not fully conscious.³
- (2) Different Body: A mind, soul, or consciousness travels in time and moves to a different host body. What happens to the host mind in the meantime is often not explained, though there are a few popular options:⁴
 - (i) Body swaps—two minds (souls/consciousnesses) exchange bodies. This happens without time travel in the movie *Freaky Friday* [11], and also Locke's example of the prince and the cobbler [12].⁵
 - (ii) Body switches—one mind (/soul/consciousness) moves to a host body, and the mind (/soul/consciousness) that was originally in the host body ceases to exist. An example of this is the 2016 TV series *Travelers* [3], where the minds of thousands of time travelers from the future are sent back into host bodies of present-day people who are about to die, overwriting the minds of those present-day people. The original bodies left behind are dead—left like the

husks of seeds or insects after they have molted. (A variation on this category includes stories of a mind relocating to an inanimate object such as in the light novel series *Reborn as a Vending Machine, I Now Wander the Dungeon* [13])

- (iii) Possession. This involves the co-existence of two persons within one body. A mind (/soul/consciousness) moves to a host body and co-exists with the mind (/soul/consciousness) of the host for a period of time. An example of this (without time travel) is Stephanie Meyer's novel *The Host* [14].

It will also be helpful to categorize transmigration time travel fiction by the metaphysical presuppositions of the transmigration (bearing in mind that a lot of transmigration time travel fiction leaves these unclear).

(A) Dualist transmigration:

Relocation of an immaterial soul presupposes dualism and also presupposes that the identity of a person is determined by their soul—they go where their soul goes. In philosophical terms, it presupposes the soul view of personal identity according to which the persistence through time of a person is determined by the persistence of their immaterial soul.⁶

(B) Physicalist transmigration:

A physicalist relocation of a mind could be achieved by a head or brain transplant but that does not fall under the category of transmigration—as I have said, the idea of transmigration requires a mind, soul, or consciousness relocating without any part of their body. Physicalist transmigration requires two related assumptions: first, a view about the persistence of persons—the psychological view of personal identity. This is the view that a person goes where their mind goes. Second, a presupposition about the persistence of minds—that the mind can be relocated to a different body.

Many physicalist views are consistent with the psychological view of personal identity, and so they allow for a mind to be relocated to a different body. For example, Functionalism, and, in particular, a version of Functionalism—the Computational Theory of the Mind—seem to allow for the coherence of transmigration.

According to Functionalism, the mind is the “functional organization” of the brain, where functional organization is defined by causal relations from inputs and outputs from the body.⁷ Functionalist views seem to allow for the coherence of transmigration; there seem to be only practical obstacles, not logical obstacles, to modifying a host brain in such a way that its functional organization is identical to that of the time traveler's original brain.

The Computational Theory of the Mind is a version of functionalism that states that the mind is the software of the brain.⁸ Again, transmigration of the mind seems to be coherent according to the Computational Theory of the Mind; just as a computer software program can be transferred to different computer hardware by reprogramming it, a brain can conceivably be overwritten with the software of another mind.

However, not all transmigration time travel stories are coherent on a physicalist view. For example, most physicalist views of the mind will not allow that a person's mind could be transferred to a vending machine, though perhaps the Computational Theory of the Mind could allow this provided that the vending machine was sophisticated enough.

A distinction that is commonly made in time travel stories is between instantaneous (or jump) time travel and continuous (or gradual) time travel. Continuous time travel takes personal time—a non-zero amount of personal time elapses on the journey; instantaneous time travel takes no personal time. However, there seem to be very few transmigration time travel stories involving continuous time travel. A dualist version of continuous transmigration time travel seems to be coherent: a soul could exist disembodied for a period of personal time during the journey. Some physicalists will also accept the coherence of continuous transmigration time travel. For example, on the Computational Theory of the Mind, it is conceivable that a mind could be stored as a software program in a time machine during a time travel journey that takes personal time. However, other physicalists will not accept that a mind can persist disembodied, and the closest that they will allow to continuous transmigration time travel is a two-stage process: first, transferring a mind to a

new body and, second, that body and mind together undergoing continuous time travel to the past.

3. Lewis's Definition of Personal Time

In this section, I introduce Lewis's definition of personal time and the rest of his framework for time travel (as in [19]) and explain why his definition of personal time is inadequate for capturing transmigration time travel fiction.

Lewis assumes the four-dimensional manifold of space-time. This is something like the picture of space-time from Special Relativity or General Relativity, though Lewis never mentions details such as time dilation or closed time-like curves, and his framework for time travel does not rely on such things. As opposed to Presentism or the Growing Block Model, all times, past, present, and future, exist *simpliciter* and are ontologically equivalent, and the passage of time must be reconceived, as "now" is simply relative to the observer.

Crucially for us, there is only one dimension of time in the four-dimensional manifold of space time—no extra dimension as in the hyper-time model of time travel.⁹ This limits us to strictly one version of events: one past, one present, and one future. This limitation already implies that many transmigration time travel fictions are inconsistent in a Lewisian approach, including most fictions mentioned in the previous section. For example, in the *Travelers* TV series [3], there are multiple versions of events—in fact, the goal of the time travelers in this TV series is to travel back in time to change the past, in order to change their present and future. Other transmigration time travel fictions do not require changing the past, such as the story from Perry above, where one soul repeatedly travels back in time to be the soul of every person in the universe.

Lewis's definition of time travel depends on his concept of personal time.¹⁰ External time is simply the dimension of time described by modern physics—the time dimension from the manifold of space-time. Lewis introduces personal time by explaining that, roughly speaking, it is the time that it reads on the time traveler's wristwatch. A time traveler may be sitting in his time machine, traveling backwards in external time, but his watch hands are turning clockwise, so he is traveling forwards in personal time. According to Lewis, this kind of discrepancy between personal time and external time is what is required for time travel. Personal time is not an additional dimension of time, but just an assignment of a coordinate to each event that may differ from its coordinate in external time. As Lewis, says, personal time "isn't really time, but it plays the role in [a time traveller's] life that time plays in the life of a common person" [19] (p. 146).

Lewis quickly moves on from his rough definition of personal time in terms of the time traveler's wristwatch to give his preferred definition of personal time. This is the assignment of coordinates to the stages of a time traveler's life, that gives the familiar changes and regularities in a person's life. As examples of these regularities, he lists first infantile stages and lastly senile stages, the accumulation of memories, the stages of digestion, and hair growth. In essence, Lewis is defining personal time by the time traveler's body clock. He points out that this is a "Functional definition" because it defines personal time as whatever plays the same functional role in the time traveler's life that external time plays in an ordinary person's life.

Let us pause here to look more closely at Lewis's move from the Wristwatch definition of personal time to his Functional definition of personal time, and to clarify his definition of personal time. One obvious point of improvement is that his Functional definition allows for time travelers who are not wearing wristwatches. Lewis mentions a second improvement, which is that the Functional definition does not make "watches infallible by definition" [19] (p. 146). Now, you might worry that Lewis has moved from making watches infallible by definition to making time travelers' body clocks infallible by definition and be unsure whether this is an improvement. We all know that our body clocks are less regular than the average watch and can be easily compromised by such factors as coffee and stress.

The challenge is whether personal time, as Lewis has defined it, agrees precisely with external time in ordinary cases—cases where no time travel has occurred. Suppose that by the phrase “good wristwatch”, I mean a wristwatch that is reliable and accurate at measuring external time in cases where no time travel occurs. Then, the following Counterfactual Wristwatch definition of personal time seems to capture the intention behind Lewis’s definition of personal time: personal time is the time that it would read on a good wristwatch if it were constantly present at all the stages of that person’s life. For a “good wristwatch”, we could substitute the phrase “cesium atomic clock”, as this is one of the most reliable and accurate clocks that we can currently construct.¹¹

Daniels gives a different reading of Lewis’s Functional definition (which we may call the Corrected Functional definition), which may be able to correct for abnormalities in a person’s customary regularities due to coffee, stress, or other factors. I have assumed that Lewis is simply trying to construct an accurate clock using the time traveler’s body clock. Instead, Daniels assumes that we will calibrate his body clock against external time, by using what we know about that person’s customary regularities when they are not time traveling. Daniels says, “[W]e can say that if in the closest possible world where [. . . he] is not a time traveller it takes him, for instance, a week to grow a full beard, we can say it takes him a week of personal time to grow a beard in any appropriately nearby worlds, whether or not he time-travels therein.” [22] (p. 334).

You may ask whether we are entitled to the assumption that the time traveler’s beard grows at the same rate regardless of whether he is traveling forwards or backwards in time. Unfortunately, there does not seem to be any avoiding this sort of assumption. The Counterfactual Wristwatch definition of personal time also relies on the same kind of assumption: that cesium atoms vibrate at the same frequency regardless of whether they are time traveling. Daniels’ Corrected Functional definition of personal time seems like a good idea, and it may even have been the way that Lewis intended it to be interpreted.

Another crucial part of Lewis’s framework for time travel is Lewis’s definition of personal identity, that is, the persistence of a person over time. For Lewis, personal identity consists of psychological connectedness and psychological continuity (chains of psychological connectedness), along with causal continuity between stages. Lewis argues that for a time traveler, we need to apply this definition of personal identity relative to the time traveler’s personal time, not external time, or we may mistake them for two separate persons.¹² We will return to this issue in more detail in the next section.

Lastly, let us attempt to apply Lewis’s definition of time travel to transmigration time travel fiction. The basics of these stories seem to fit with Lewis’s framework. Suppose first that a person’s mind, soul, or consciousness time travels between different stages of their own body. Lewis could allow that the temporal stages of a person’s mind or soul can be ordered differently from the temporal stages of their body. So, for example, a 13-year-old’s soul could jump forwards in time to inhabit her 30-year-old body, as in the movie *13 going on 30* [7]. Assuming physicalism, a 13-year-old’s mind could also time travel forwards to inhabit her 30-year-old body, if we assume something like the Computational Theory of the Mind. What is not allowed by Lewis’s framework is for there to be two versions of external time, one version of events for the first time she turns 13 and a different version of events for the second time she turns 13.

Suppose next that a person’s mind, soul, or consciousness travels in time to a different body. Again, Lewis could allow that the stages of a person’s mind or soul involve two different bodies. A time traveler could jump back in time to overwrite the mind of a dying person, just as in the *Travelers* TV series [3].

However, trying to apply Lewis’s definition of personal time to any of these cases immediately leads to problems. If someone time travels by transmigration time travel, then we will not be able to order all the stages of their life into a customary order by their physical properties. For example, suppose that an elderly man, Fred, swaps bodies with an infant. First, Fred survives from infancy to old age without any transmigration or time travel. Then, Fred jumps back in time into an infant body different from his own by

overwriting the host brain of the infant. Finally, Fred survives in the infant's body without further time travel through infancy to middle age, old age, and death. In total, Fred's life includes two distinct sets of infantile stages, middle age stages, and elderly stages from different bodies and we are unable to order these in one familiar ordering using their physical properties.

The Wristwatch definition of personal time and the Counterfactual Wristwatch definition also do not seem very helpful here, due to the difficulty of attaching a watch to a mind, soul, or consciousness.

4. Modifying Lewis's Definition of Personal Time

In order to capture transmigration time travel in a Lewisian framework, we need to refine Lewis's definition of personal time. A first attempt to do this is what we shall call the Solely Mental Functional definition of personal time. This involves modifying Lewis's definition so that personal time is defined solely by customary mental regularities, not customary physical regularities. Which mental regularities are suitable for this purpose? Lewis mentions the accumulation of memories. However, this one regularity alone seems to be insufficient for defining personal time. People accumulate new memories in a fairly regular manner while they are awake, but they do not usually accumulate new memories while they sleep (though there does seem to be an exception when people remember their dreams). Surely a satisfactory definition of personal time should imply that personal time continues to elapse while we sleep.

Are there other suitable mental regularities for the purpose of defining personal time? Plenty of brain activity does continue while we sleep: our brain continues to control our breathing and heart, the process of consolidating memories continues, our brain monitors our environment for loud noises which will wake us, and so on. Not all background brain activity constitutes *mental* regularities, but some of it seems to, so a Solely Mental Functional definition of personal time seems promising. It is closely related to the psychological continuity and connectedness criteria of personal identity that Lewis subscribes to, and it makes sense that we find a way to define personal time in terms of the relations involved in the persistence of a person.

Does the Solely Mental Functional definition of time also work for dualists, when applied to transmigration time travel? For dualists, personal identity is defined by the continuation of the soul. However, which customary regularities of an immaterial soul can we use to define personal time? On some views of the soul, souls are the bearers of mental properties.¹³ This may imply that mental properties continue and accompany the soul wherever it travels. If this is so, it seems that we can still appeal to customary mental regularities to account for cases of transmigration time travel, and the Solely Mental Functional definition of personal time still succeeds. Other dualists, such as Plato, believe that the soul is unchangeable. This is more of a challenge for analyzing personal time. Nonetheless, it may still be possible to order the temporal parts of the soul using the causal relation, as I discuss below.

Even though the Solely Mental Functional definition of personal time is promising, it is not a fully general definition of personal time. Take the case of the time travel of purely physical objects like tables and chairs. These objects cannot undergo transmigration time travel as they have no souls, minds, or consciousness, but they can still undergo ordinary time travel. We need a Solely Physical Functional definition of personal time for such cases.

What lesson should we draw from this? In the case of persons, we have limited ourselves to mental properties. In the case of tables and chairs, we have limited ourselves to physical properties. It might seem as though we need different definitions of personal time for different kinds of objects.¹⁴ One complex case is that of artworks with multiple instances. Rodin's sculpture "The Thinker" has multiple instances, and a definition of personal time for this sculpture would need to allow for the possibility of new instances made from existing molds, and also take into account whether these are sanctioned by the artist. One way for "The Thinker" to travel back in time would be for a mold to be sent

back in time to ancient Greece and for a sculpture to be produced from this mold when it arrives in the past.¹⁵

A unified definition of personal time would be preferable to multiple definitions of personal time, as this would make it clear that “personal time” is univocal, rather than ambiguous. One thing that nearly all definitions of persistence have in common is a requirement of causation between earlier and later temporal parts of the object or person (or for those who do not believe in temporal parts—causation between earlier and later events involving the object).¹⁶ Perhaps this alone will be enough to define personal time. It is difficult to see how causation can provide a full metric of time, but it does seem plausible that causation can provide the right *ordering* of temporal stages in personal time, reflecting the order of persistence.

Suppose that I decide to travel back in time to revisit the beautiful sunrise I saw this morning at 6 am. At 10 am, I get into my time machine, and 56 min later, I arrive at 6 am. Ordering my temporal stages by causation means to order them so that causes always precede effects in personal time. If, by this ordering, later stages of my life precede earlier stages, then we have time travel backwards in time. However, what is to say that this took 56 min and not 57 min? Causation alone allows us to order the stages of a person or object, but is not enough to enable us to compare the duration of time intervals by personal time (unless one time interval happens to be included in another).

In the same way, causation can give us an ordering of the temporal stages of minds, tables, chairs, and even souls. If all that is needed from a definition of personal time is an ordering, then causation gives us a fully general ordering that applies to all the cases we have previously discussed. Even if a table is unchanging and stationary, its presence at one time is a cause of a presence at later times. And if the table travels backwards in time, then the ordering of its stages by causation will differ from the ordering of its stages in external time. Even if a soul is unchanging and stationary, it is plausible that one temporal stage of the soul is a cause of later temporal stages of that soul.

While a discrepancy between the ordering of the temporal stages of an object or person in personal time and in external time identifies backwards time travel, unfortunately, it is not enough to identify forwards time travel. Suppose that a time traveler to the future brings a good wristwatch with them, and inside their time machine one hour elapses as measured by that wristwatch, while one hundred years of external time elapses. The wristwatch definition of personal time shows that they have time traveled to the future; however, the causal ordering of their temporal stages is just as would be expected if they had not time traveled. It seems that causal ordering alone is not enough to identify this as forwards time travel.

Wasserman also proposes a definition of personal time in terms of causation. His main motivation is that Lewis’s Functional definition of time travel only applies to people. He suggests defining personal time as “an assignment of coordinates that . . . [tracks] the causal relation that makes for identity over time (for a specific individual).” [21] (p. 67). He says, “In order to broaden our account of personal time, we must move beyond the functional definition. Ideally, what we would like to find is a perfectly general relation that could provide an order and metric for any object, whether it be a person, a particle, or a time machine. The most obvious candidate for this job is *causation*, since it is generally agreed that identity over time requires causal dependence” [21] (pp. 7–8).

Thorpe makes the following objection to Wasserman’s causal definition of personal time: “Say that the intrinsically unchanging electron does time travel. At some point, it enters a wormhole and it appears back in the past. No doubt that in such case the electron time travels. Yet, Wasserman’s causal definition does not predict so. In fact, it is plausible to think that causal relations among the stages of an object necessarily bring about some kind of intrinsic change in that object. But the electron never undergoes any kind of intrinsic change, and hence there isn’t any causal relation among its stages. Therefore, if the personal time of an object is the ordering provided by the causal relation among its stages, we don’t

even have personal time for the electron here, and hence no mismatch between its personal time and external time” [25] (p. W383).

I do not share Thorpe’s reservations here. In reply to his objection, none of the main philosophical approaches to causation require intrinsic change in a cause or effect. None of the main philosophical approaches to causation require any kind of change in the cause or effect—intrinsic or not. For example, Singularist approaches to causation treat causation as a primitive relation in the world that cannot be reduced to regularities or other facts. No change in the temporal stages of an electron is required for them to be related by a primitive causal relation. Counterfactual approaches to causation also do not require changes in an object that is cause. Instead, what is required for causation between two stages of an electron is counterfactual change: that *if* there were a change to a first stage, then there would also have been a change to the second stage. Similarly, in Interventionist approaches to causation, all that is required is counterfactual change: that *if* we were to intervene in the first stage, then there would be a change in the second stage.

The Causal definition of personal time seems to be satisfactory for an ordering of stages in personal time, and to capture what is going on in most transmigration time travel fiction, which mostly involves backwards time travel. For the best of both worlds, we can combine the Causal definition of personal time with the Solely Mental definition of personal time, so that we consider the customary mental regularities of a person, and the causal links between them in constructing personal time. (We can call this the Causal Mental definition of personal time).

In summary, once Lewis’s definition of personal time is modified, many transmigration time travel fictions are consistent with it. I have considered two main modifications of Lewis’s definition of personal time: a Solely Mental Functional definition and a Causal definition (also discussed by Wasserman). These both seem to be successful in analyzing cases of transmigration time travel fiction. However, there are significant limitations to each of these approaches. The Solely Mental Functional definition is limited to the time travel of beings with minds, and the Causal definition can only provide an ordering, not a metric, for personal time and hence cannot account for cases of forwards time travel. A Causal Mental definition of personal time combines both approaches and seems to improve on the Solely Mental definition, though again it is limited to beings with minds.

5. Reverse Aging and Personal Time

In this section, I consider two cases involving reverse aging but no transmigration, in order to test these accounts of personal time.

Consider a time travel story from Bernstein:

“Reverse Aging: Twenty-one-year-old DeShawn presses the button on his time machine, and takes twenty years in personal time to travel back twenty years in external time. However, the time machine ages him backwards at a rate of one year per year, such that his body and bodily processes match those of a one-year old baby upon his arrival in the past.” [26] (p. 249).

According to Bernstein at least, Lewis’s Functional definition of personal time mistakenly fails to recognize this story of reverse aging as time travel. Her thought seems to be that the ordering of DeShawn’s temporal stages by the customary processes of aging is the same as their ordering in external time, so this is not a case of time travel.

This example is under described. The way I understand it is that we modify what Lewis counts as a typical case of a continuous time travel journey to the past in just one respect—so that “the time machine ages [DeShawn] backwards at a rate of one year per year”. In a typical case of continuous time travel to the past, *all* of DeShawn’s bodily processes and brain processes and the causal links between them would be reversed to their customary order with respect to external time during the journey. Modifying this typical case so that “the time machine ages [DeShawn] backwards”, the ordering of his temporal stages with respect to external time would again appear to be customary (so that a stage where his body appears to be 19 years old precedes a temporal stage where his

body appears to be 20 years old). Customary aging also involves causal links: a fine line (a cause) becomes a wrinkle (an effect). Bernstein does not explain what happens to these causal links, but “the *time-machine* ages him backwards” suggests to me that in the time machine wrinkles (causes) become fine lines (effects), rather than the customary causal ordering. Interpreted this way, a Causal account of personal time succeeds in classifying this as a case of time travel; the ordering of stages with respect to their causal ordering is reversed from their ordering with respect to external time.

I agree with Bernstein that this case is problematic for Lewis’s functional account of personal time, simply because Lewis’s functional account of personal time is silent about cases where some bodily processes are in their customary ordering and others are not. (I am presuming here that not all bodily processes are processes of aging. For example, I first open doors then walk through them, and that is nothing to do with aging.) For the same reason, this case also seems problematic for the Solely Mental Functional criterion of personal time, as some but not all mental processes seem to be processes of aging too.

A related case occurs in the movie *The Curious Case of Benjamin Button* [27]. The protagonist’s body ages in reverse throughout this movie, but there is no time travel. So, Benjamin is born resembling an elderly man, and his body appears to grow younger throughout the movie until he dies with the body of a baby. This again seems to be problematic for Lewis’s functional definition of time travel. Again, some customary regularities are reversed and others (for example, eating, digestion) are not, and Lewis’s functional account of personal time is silent about such cases. However, the causal ordering of the stages of Benjamin’s body seems to be the usual ordering for a non-time-traveler, with causes preceding effects in external time. So, the Causal definition of personal time correctly identifies this case as involving no time travel. The movie also makes it very clear that Benjamin’s mind ages forwards in external time while his body ages backwards. For example, he can remember experiences from earlier in external time when his body appeared to be older. So, the Solely Mental Functional account of personal time correctly identifies this as a case that is not time travel.

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Notes

- ¹ I call this “transmigration time travel”, as the category is slightly broader than mental time travel by including possible cases where the time traveler’s soul time travels without their mind. The phrase “mental time travel” has also been used in the popular psychological theory of Suddendorf and Corballis, which names ordinary memory and anticipation “mental time travel” but does not involve any real time travel in our sense [1].
- ² For example, many Christians believe that after the Day of Judgment, the dead will be resurrected, either by a spiritual resurrection (soul only) or by a physical resurrection (where the soul is returned to the body).
- ³ However, the last scene of this movie leaves it unclear whether any time travel happened or whether it was all a dream.
- ⁴ One case of transmigration fiction where it is unclear what happens to the host mind is the movie *Source Code* [9]. The 1980s TV series *Quantum Leap* [2] seemed to involve a body swap, with the main character Sam leaping into different host bodies in different episodes, and the host consciousness leaping to Sam’s body in a waiting room in the meantime. However, in the 2022–2023 reboot of *Quantum Leap* [10], it is not made clear what happens to the host consciousness during Sam’s leaps.
- ⁵ “...should the soul of a prince, carrying with it the consciousness of the prince’s past life, enter and inform the body of a cobbler as soon as deserted by his own soul, everyone sees he would be the same person with the prince, accountable only for the prince’s actions...” [12] (Book 2, chapter 27,15)].
- ⁶ However, Buddhist teachings claim transmigration without the soul view of personal identity. They combine *samsara*—the natural cycle of birth and rebirth—with *anatman*—the impermanence of the self.
- ⁷ For example, see Putnam [15] and Lewis [16].

- 8 For example, see Block [17], Fodor [18], and Putnam [15].
- 9 For the hypertime model of time travel, see [20].
- 10 Note that there have been a few attempts to make Lewis's definition of personal time consistent with Special Relativity, which we have not considered here. For example, see Wasserman [21] chapter 2, section 5, and Daniels [22].
- 11 Wasserman also discusses this sort of counterfactual definition and rejects it. First, he assumes that "a perfectly functioning clock" is one that "correctly tracks personal time" [21] (p. 6). Wasserman is right to point out that this definition is circular, but our definition of an accurate clock is in terms of external time, not personal time, and so it does not suffer from this circularity. Second, Wasserman says, "Also, counterfactual definitions never work. Suppose, for example, that the Doctor is traveling in the TARDIS and that he has developed an unusual phobia of time traveling while wearing watches. So, if he *were* wearing a watch at this time, he would immediately stop the TARDIS. In that case, there would no longer be any discrepancy between external time and personal time (as currently defined). So, the definition would incorrectly entail that the Doctor is not currently time traveling." [21] (footnote 16, chapter 1). For our purposes, this sort of counterexample is not really important, and the Counterfactual Wristwatch definition or the Corrected Functional definition will both be fine.
- 12 Lewis also points out that there is a circularity in his definitions of personal time and personal identity: his definition of personal time presupposes that we have already identified all the stages of one person, and his definition of personal identity presupposes that we already have an ordering of these stages in terms of personal time. This is a circularity, but not a vicious one, so Lewis suggests that we just define the two concepts simultaneously. [19] (p. 47).
- 13 For example, Swinburne says, "Souls are immaterial subjects of mental properties. They have sensations and thoughts, desires and beliefs, and perform intentional actions. Souls are the essential parts of human beings, and humans have sensations etc. and perform intentional actions in virtue of their souls doing so". [23] (p. 333).
- 14 Influenced by Locke [12] (Book 2, chapter 27), many philosophers claim that there are different persistence conditions for different kinds of objects. (A related view is the sortal relativity of identity). If we also allow different definitions of personal time for different kinds of objects, then it seems we should limit each definition of personal time to properties that are required for the persistence of that kind of object.
- 15 For the sculpture in the past to count as sanctioned by the artist, the mold could be sent together with a letter of permission from Rodin, or from the nation of France to which Rodin left his estate. If all instances of the sculpture existing in the twenty-first century happen to have been destroyed prior to the trip, then this may be a case where there is a temporal gap in personal time in the existence of the sculpture. Compare this to Parfit's example of a gold watch that lies disassembled on a watch-repairer's shelf for a month [24]. These two cases also seems to be analogous to cases of transmigration time travel where a disembodied mind or soul travels through time to a different body.
- 16 Perdurantists, like Lewis, claim that objects are four-dimensional—they are spread over both space and time. For perdurantists, objects persist over time ("perdure") by having different temporal parts at different times. Different theories of identity over time require these temporal parts to stand in the right relation to each other. Endurantists, on the other hand, claim that objects are three-dimensional; they do not have temporal parts. For endurantists, objects persist over time ("endure") by being wholly present at different times. Theories of identity over time will need to be stated in different ways for different endurantists. For example, a presentist endurantist may require that the psychological characteristics that an object once had are causally related to the psychological characteristics that an object presently has.

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