

Implications of fission, fusion and teletransportation to a view of personal identity through psychological continuity

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Giving a robust account of personal identity has been a major metaphysical goal. There have been numerous accounts of exactly what constitutes personal identity, including theories of physical and psychological continuity. In this essay, I shall focus on the view of identity as psychological continuity and on how the recent ideas of teletransportation, fission and fusion affect such a view. I shall explore several new consequences of these ideas and show how the psychological continuity approach to identity can address these challenges in interesting – if initially unintuitive – ways.

1. Classical accounts of personal identity

The fundamental problem for a theory of personal identity is to determine criteria to say whether a person, p_1 , at a time, t_1 , is identical to a person p_2 , at time, t_2 . The account given must also explain exactly what it is about these criteria that makes them necessary and sufficient for personal identity. In this section, I shall introduce three main accounts of personal identity: strict identity, physical continuity and psychological continuity.

The simplest account of personal identity is that it is just an application of *strict identity* to persons. Strict identity is the identity relation used in formal logic. It is a special case of an equivalence relation and thus is: reflexive (everything is identical to itself), symmetric (if x is identical to y , then y is identical to x) and transitive (if x is identical to y , which is identical to z , then x is identical to z). These constraints are very intuitive and sum up much of our pre-philosophical notions of identity. However, there are relations other than identity, which also fulfil these constraints (such as is-the-same-height-as). Strict identity is thus commonly defined in a more specific manner, by the following two axioms of second order logic:

I. For each object, x :

x is identical to x .

II. For all pairs of objects, x and y :

if x is identical to y , then every property that is possessed by x is possessed by y .

While these axioms provide the necessary conditions for strict identity, they do not entail its sufficiency. To this purpose, one can add the ‘identity of indiscernibles’¹:

III. For all pairs of objects, x and y :

if every property that is possessed by x is possessed by y , then x is identical to y .

In his book, *Identity and Essence*, Baruch Brody defends the use of strict identity, as defined by these three axioms, for characterising the metaphysical notion of identity over time². He argues quite convincingly that strict identity avoids some of the difficult metaphysical problems involved.

One major problem for all theories of identity over time (including theories of personal identity) is that a given object can have different properties at time t_1 to those at t_2 – in other words, that objects can survive change. At first glance, this would seem to be denied by axiom **II** above, which states that identical objects must have all of the same properties.

Strict identity as an account of identity over time can avoid this problem by considering objects as four-dimensional entities, with three spatial dimensions and one time dimension. On this account, a person may be considered as a long ‘worm’ of three-dimensional person-slices, with small baby shaped slices at one end and large adult shaped slices at the other. Brody uses such a space-time account to say that persons p_1 and p_2 are the same if and only if they have the same properties at the same times³.

This gives a reasonably succinct account of identity over time, avoiding many pitfalls and neatly tying it to identity in formal logic. It shows us that there is no fundamental metaphysical difficulty in identity over time, while at the same time, providing some interesting support for a four-dimensional worldview.

Unfortunately however, it has almost no explanatory value when it comes to helping with difficult questions of identity. For example, consider a person, p_1 , who walks into a room and is then given a drug to make him lose all of his memories and many of his distinctive mental characteristics. Is the person, p_2 , who later leaves the room the same person as p_1 ?

This is a non-trivial question and an answer to it requires considerable explanation, which strict identity fails to give. On Brody’s account, p_1 and p_2 are identical if and only if ‘ p_1 and p_2 have, at all times, the same properties’⁴. This fails to provide any explanation of the case presented here. It simply reduces the problem to that of looking through all time slices of each person and checking their properties. While this may be a metaphysically easier task, it is of no real practical or conceptual use without

a further account of which of these ‘person-slices’ can be joined together to make a four-dimensional person.

If arbitrary combining of person-slices is allowed, then we can easily construct a four-dimensional person of which any two non-simultaneous person-slices are parts. This would mean that the truth-values of claims about the identity of persons over time are also arbitrary. Such a view is reasonable when talking of many everyday entities such as tables or nations. The exact degree of change that a table or nation can survive is quite arbitrary and there is reason to believe that there is an inherent ambiguity in identity claims about such objects⁵.

Personal identity, on the other hand, seems to be describing a more objective relationship. For example, the question of whether or not certain persons are identical has considerable implications in most theories of ethics and rationality. We feel that it would be rational for someone to have a special interest in the welfare of a person whom she will become in the future. Thus, it seems that a sensible explanation of personal identity cannot allow its four-dimensional persons to be constructed from arbitrary person-slices. To really capture this notion of identity, we need a robust account of exactly how person-slices connect to form persons.

Two major approaches to this problem are those of *physical continuity* and *psychological continuity*.

Physical continuity holds that p_1 is p_2 if and only if p_1 's body is spatio-temporally continuous with p_2 's body. Thus, those that hold physical continuity believe that it is possible for someone to lose an arm – or indeed slowly replace every atom in their body – without changing their identity, but that the changes must be gradual enough.

A popular attack against this claim of bodily continuity is that we can imagine a situation in which two people have their brains removed and placed in each others' bodies⁶. In this case, their bodies will undergo a most discontinuous change, but it is quite conceivable that their minds are not affected. Most people are now fairly comfortable with such cases, believing firmly that (if the experiment was a success) each person would wake up in the other's body and have control over it. Thus, adherents of physical continuity now generally regard the brain as that object whose continuity is required for personal identity.

The other approach began with Locke, who claimed that for p_1 at t_1 to be p_2 at t_2 , p_2 must remember being p_1 ⁷. This approach of personal identity as memory connectedness had some intuitive advantages over the physical continuity theories

because we tend to have strong feelings that our ability to remember our past is intimately related to our identity. However, a problem with the approach was discovered – it leads to a non-transitive relation. If we add a person p_3 to our account, we may have that p_3 remembers being p_2 , but not p_1 . In this case, p_1 is p_2 and p_2 is p_3 , but p_1 is not p_3 . This is intuitively strange, since we would expect personal identity, like strict identity, to be transitive. Personal identity as memory connectedness has therefore mostly been replaced by the newer concept of personal identity as memory continuity⁸, in which p_1 is memory-wise continuous with p_n if and only if there is a chain of people ($p_n, p_{n-1}, p_{n-2}, \dots, p_1$) such that p_n remembers being p_{n-1} , p_{n-1} remembers being p_{n-2} , and so on down to p_1 .

This approach of memory continuity has been further criticised and refined on two counts. Firstly, it is accused of being question begging by referring to memories which are usually to be understood as knowledge of events that occurred to someone in their past. Talking about ‘someone’ and ‘their past’ like this already assumes some means by which we can identify persons.

This problem can be resolved by replacing the concept of memory with the concept of *quasi-memory*⁹ which is like true memory in that: it seems to the person like a true memory, the experience being quasi-remembered was actually had by someone, and the quasi-memory is dependent upon the actual experience in the same way as a real memory. The only difference is that it does not definitionally require that the person who experienced and the one who remembers are identical.

The other main criticism of memory continuity is that, while important, it is not necessary for identity. For instance, opinions differ on whether undergoing complete amnesia (breaking all (quasi-)memory continuity) – but not changing your personality or other mental characteristics – would stop you being the same person that was in your body pre-amnesia. It can also be claimed that memory continuity is not sufficient, because you could imagine that one day, the person in a given body might be able to quasi-remember what the person in that body the day before did, but be completely dissimilar in terms of mental and emotional characteristics. There is thus some need for theories of *psychological connectedness* and *psychological continuity*, where the relevant connections are a combination of memory with other mental characteristics.

For the remainder of this essay, I shall examine the implications of a view of personal identity as psychological continuity. Instead of further fleshing out exactly what form of psychological connectedness is required for identity, I will follow the tradition of leaving this vague enough to cover a range of views¹⁰. Even without additional specification, we will see many remarkable implications of the psychological continuity view.

2. Teletransportation

A prominent example in which there is psychological continuity without bodily continuity is *teletransportation*, popularised by Derek Parfit¹¹. Imagine a person, p_1 , entering a small chamber and typing a place name into a computer terminal. She is then made unconscious with a drug and scanned by a complicated apparatus which records the position and related information about every particle in her body. Her body is then destroyed and the scanned information is sent to another chamber in the desired location. It is then used by a similar apparatus to assemble a person, p_2 . The drug slowly wears off and p_2 wakes up and leaves the chamber. She acts just like p_1 did beforehand and says that her ‘transportation’ felt just like falling asleep and waking up again somewhere else.

Such teletransporters are logically possible and are common in science fiction stories. Readers and viewers of such stories tend to readily accept that the person leaving the second chamber is the same person that entered the first chamber, but some have a radically different view, seeing a teletransporter as a high technology killing device that simply creates a replica of the person it destroys¹².

There are certainly strong reasons to assume that p_2 is p_1 . For example, we can consider a second scenario, where a person p_1^* enters the chamber and is drugged, then simply moved by a machine to the second chamber, where she wakes up as p_2^* .

In this scenario it is clear that p_2^* is p_1^* , so any argument that p_2 is not p_1 must point out a relevant distinction between the two cases. Since at every moment, p_1 's experiences are identical to p_1^* 's and p_2 's are identical to p_2^* 's, there seems to be no relevant difference to prevent p_1 being the same person as p_2 . p_2 will be simply unable to distinguish her experiences/memories/motivations from those she would have had if she had travelled by conventional means and retained her identity. While there are certainly differences between p_2 and p_2^* – p_2 was at some stage built by a machine, while p_2^* was not – these differences do not seem to be relevant to personal identity.

If we accept a materialist account of the mind, we can make this claim more precise. Since a mind-state is completely determined by the physical configuration of the body, and at every time, p_1 and p_1^* have identically configured bodies, they must have exactly the same mind-states as well. This is also true for p_2 and p_2^* . Thus, we can say that not only are the memories and experiences the same in both cases, but the entire sequence of mind-states is as well.

To hold that p_1 is destroyed by the machine and replaced by the non-identical p_2 , we have to assume that there are two separate people, with the death of one being psychologically continuous with the creation of another. This view is considerably

more complex and yet experientially and experimentally indistinguishable from the other view. We should therefore resist supporting it unless we see that there are hidden implications of the first view that make it more complex or even incoherent.

From here on, I will assume that persons can survive teletransportation. I shall then examine some of the very interesting implications of such a view. As we shall see, they become quite unintuitive and may initially be considered incoherent. However, I will attempt to show that they actually present a coherent view of persons, which, while quite unconventional, perhaps provides some surprising insights into personal identity.

One of the more direct implications of this view is that persons can have temporal discontinuities. More precisely, a person can have two person-slices that are separated by a period of time and have no person-slices between them. This is the case in the teletransportation scenario above. There is considerable temptation to deny such a possibility, because of an intuition that objects (and persons) must be spatio-temporally connected.

While many people may initially agree that we cannot have spatially disconnected objects, closer examination shows that we do not really adhere to this. Science tells us that almost all everyday objects are made of atoms and that these are not connected together by matter. Most people believe this account of objects even though it directly implies that our everyday objects are not spatially connected. While this was initially considered an unintuitive consequence of the scientific account of material objects, it is now seen as compatible with our everyday conceptions of objects.

Even conceding this, it can still be argued that temporally disconnected objects are significantly different from spatially disconnected ones. This intuition fits with most examples of temporally disconnected objects (such as the collection of all the person-slices of Bill Clinton on Sundays) which seem quite arbitrary or bizarre. It is argued that an object ends at the first moment that it fails to have an object-slice – all the future object-slices under discussion are really parts of other objects. The only real weight that an argument like this holds is its alleged simplicity and intuitiveness in comparison to the view of temporally disconnected objects. In this case, however, I believe that the view of persons with temporal discontinuities is the simpler and more elegant. There is no ontological economy gained by assuming that the parts of the traveller after replication are of a separate (but mentally indistinguishable) person.

To better understand how a person could have a temporal gap, it is instructive to compare persons to information. The materialist view of persons has a natural interpretation in which persons are information based: since identical material implies

identical mind-states, we can think of the mind-state as encoded in the material. When a body is scanned by a teleporter and its description is stored, we have also stored a description of the mind. Thus, even in this purely materialist view, a mind-state is still a very different type of thing to a brain-state: it is an informational entity as opposed to a physical entity. At a given moment, the mind can be considered as similar to the information on a compact disc: this information is not the same as the matter of the disc, but rather, it is represented or embodied in that matter.

When you copy the information from one compact disc to another, the material is different, but the information is identical. When it comes to information, there is only one bit-string: '000110'. If this string occurs in two different places, it is still the same information*. On this view, the situation for people is very similar: a snapshot of a mind can exist outside its original body, allowing it to be placed in a new body.

This analogy, however, only runs between information and mind-states. A mind itself is not a piece of information, but it can be conceived of as a process moving from one mind-state to another. Extending the analogy above, we can relate minds to computations. Consider a computer with a program that generates the first 100 prime numbers. We could run such a program until it has generated the first 50 numbers and then abort it, using a sophisticated piece of software to extract the exact state of this program and its internal information when it was aborted. We could then copy this information to another machine and use some additional software to start it running again. In this way, the program will run from beginning to completion, but on two separate computers. On a materialist account of the mind, we can think of teleportation in the same way, with a mind (person) that is active in one body, then halted and transferred to another body where it is restarted and continues its thinking and experiencing.

Such a view depends on a materialist theory of the mind (and thus persons), but shows a way in which the initially unintuitive concept of temporally discontinuous persons can lead to interesting ideas about the nature of persons. This argument (along with those for the other consequences of teleportation which follow) is not intended to be conclusive, but rather to show how the theory of identity through psychological continuity can survive several unintuitive results in a fairly graceful manner.

Another unintuitive consequence of teleportation is that it seems to permit not only temporally disconnected person segments, but also *causally* disconnected persons. Imagine, for instance, that the transporter is malfunctioning and simply drugs and

* One could argue that two identical bit-strings are really different pieces of information if they have different causes. Such a view is not the mainstream but does have some intuitive support. This would have obvious implications in my later section on causal discontinuities.

destroys p_1 without ever scanning her or duplicating her body. Imagine then, that a bored programmer decides to write a program to generate a random person-file. The programmer runs this program and sends the person-file to another teletransporter. We would expect most random encodings of people to produce nothing more than a pile of mush or a non-working mind, but it is logically possible that the file that was generated happened to be *exactly* the file that would have been produced by scanning p_1 . Let us call the generated person p_2 .

Given the reasons discussed for identifying p_1 and p_2 in the previous scenarios, there seems to be little choice but to do so here. While p_1 and p_2 are not causally linked, they are very strongly psychologically linked. It is quite difficult to see why causal linkage should be considered relevant to the view of persons as sets of psychologically continuous person-slices.

For those who see teletransportation as non person preserving, this unintuitive consequence of the psychological continuity account will be seen as another mark against it. However, I think that the amazing unlikelihood of this situation and the absence of connections to everyday events is sufficient reason for us to have some doubt about the validity of our intuitions. In fact, this scenario is perhaps unique in providing an account of why we may actually want to allow for objects with non-causally linked parts.

3. Fission and fusion

The most discussed implication of teletransportation is the possibility that it opens of personal *fission*¹³. The simplest fission case is identical to the standard teletransportation case except that the scan is sent to two separate destinations (say Paris and London) which each construct a copy of the traveller, p_{2a} and p_{2b} .

Each of these copies is equally continuous with the original, and thus has an equal claim to being identical to the original person. They can each remember what was done before the transportation, but know nothing of what the other has done since. If they do eventually meet each other, they will know a great deal about the other's past (since they share a large amount of it) and the general mental characteristics of each other, but they will have grown somewhat apart since the transportation.

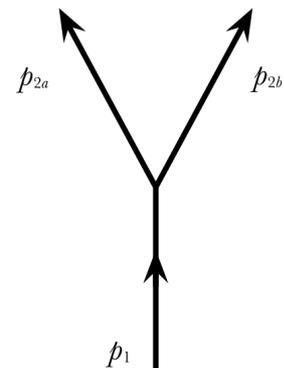


figure 1: *fission*

What then should we say of p_1 , p_{2a} and p_{2b} with respect to personal identity? Following the earlier scenarios, it would be natural to say that p_{2a} is the same person as p_1 and p_{2a} is also the same person as p_1 , since the psychological continuity they possess is a sufficient condition for personal identity. However, as has been pointed in many places, p_{2a} is not psychologically continuous with p_{2b} and there is considerable reason to *not* consider them to be the same person as each other. The problem then arises, that the personal identity relation that I have presented is not transitive, and this is considered a very serious problem by many.

Derek Parfit, who generally supports the psychological continuity criterion for personal identity and the view that persons survive teletransportation, resolves this problem by separating the notions of *survival* and personal identity. He believes that the concept of fission is enough to spoil psychological continuity as a sufficient condition for personal identity and claims that neither p_{2a} nor p_{2b} are the same person as p_1 . He weakens the psychological continuity account of identity by restricting it to cases where there is no branching. In cases with branching, he says that p_1 still *survives* as p_{2a} and p_{2b} , even though they are not identical with her. He argues that this concept of survival is what really matters in questions of ethics and rationality.

This is an interesting approach to psychological continuity and personal identity. By separating psychological continuity (and survival) from personal identity, he overcomes the problem of non-transitivity without losing the interesting implications of psychological continuity to ethics and rationality. Unfortunately, by restricting psychological continuity accounts for identity to cases that have no branching, this account conflicts with another commonsense principle of identity. This is the *only x and y* constraint and claims that the identity between two objects (x and y) cannot depend on any objects other than x and y ¹⁴. This is not very problematic for Parfit's work as he does not rely upon the notion of personal identity, just that of survival. Parfit's approach here is quite similar to mine, which will, however, follow the *only x and y* principle. Before I discuss this view, though, I will explain another important scenario put forward by Parfit.

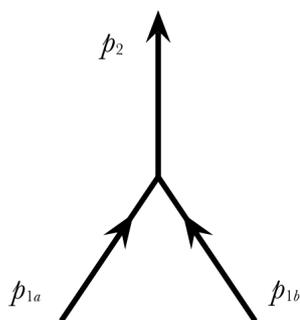


figure 2: *fusion*

As well as cases of personal fission, it is also possible to imagine situations of personal *fusion* where two distinct people, p_{1a} and p_{1b} are both psychologically continuous with a later person p_2 . Unlike fission, situations where fusion occurs tend to be very contrived. Parfit describes a situation of fusion, where two people are merged together with their mental attributes either both remaining (for non-conflicting attributes), or else assuming an averaged value¹⁵. Such a case, however, seems to be unsymmetrical with fission and to differ slightly from a more natural notion of fusion.

There are two points on which Parfit's account seems somewhat strange. Firstly, there may not be a mental-state that is directly connected to both persons. In general, there may need to be a long period of becoming similar to each other (represented by the converging arrows in figure 2). During this period, the psychological differences between the people would diminish until there is a person to whom they are both psychologically continuous. Parfit's description also makes it seem as though the fusion must occur at a point equally psychologically distant from p_{1a} and p_{1b} . However, it would seem that the only requirement is the existence of a person-slice that is psychologically continuous with both pre fission people. This could occur, for instance, with one person being relatively unchanged for the pre-fission period with another person undergoing great psychological changes until they are similar enough for fusion to be possible.

Using these concepts of fission and fusion developed above, we can create a range of new and unusual cases of psychological continuity. It is possible, for instance, that more than two people could undergo fusion or fission. It is also possible that people could undergo a simultaneous fusion and fission. In such a case, p_{1a} and p_{1b} would each have two psychological continuers and these would be the same two people for each: p_{2a} and p_{2b} . These two ideas generalise into cases where n initial people become m people. All of the above cases can be thought of in these terms: fission is a 1-2 case, while fusion is a 2-1 case.

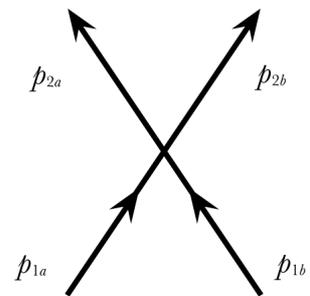


figure 3: a 2-2 case

These cases can then be connected together (in the obvious manner) to generate situations that are more complex. For instance, we could have two people who fuse, then later divide or one person who divides and whose two psychological continuers later fuse back together. Figure 4 (on the next page) shows a rather complex example of this.

I believe that even within this complex environment we can make much sense of personal identity as psychological continuity, by using the following definition:

Two person-slices, x and y , are part of the same person if and only if:

- x is a psychological continuer of y
- or
- y is a psychological continuer of x

By this definition, the emphasised lines in figure 4 represent all person-slices that are part of the same person as p_7 . p_8, p_9, p_{10} and p_{11} are all psychological continuers of p_7 , while p_2, p_3 and p_4 are all psychological predecessors.

Instead of the view mentioned earlier that persons are ‘worms’ in space-time, this view suggests that they are really examples of directed acyclic graphs – which are more like nets than worms.

While the relation defined above is symmetric and reflexive (since we can consider all person-slices to be psychological continuers of themselves) it is clearly not transitive. Parfit¹⁶ and other philosophers¹⁷ see this as sufficient reason to immediately reject an account of personal identity. Why should we not reject this one?

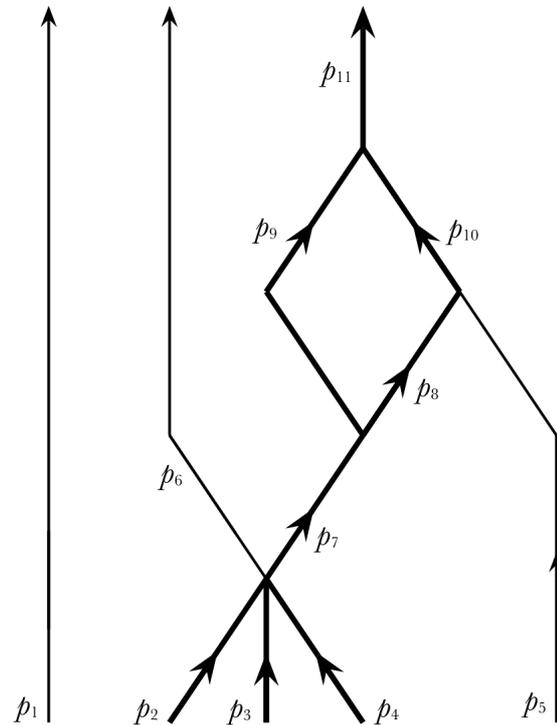


figure 4: *a more complex situation*

The short answer is that the relation defined above is not identity, but ‘being-part-of-the-same-person-as’. It is an account of how to join up person-slices into four-dimensional people – the type of account that was lacking in Brody’s theory of personal identity as strict identity. Thus, my relation is made into a complete account of personal identity only when combined with a four-dimensionalist theory of strict identity (similar, but slightly different to Brody’s). When this is done, we get a transitive theory of identity over whole persons, but with a non-transitive account of how person-slices make up a given whole person.

Let us look more closely at how this lack of transitivity is manifested here. Figure 4 contains several different complete persons which have parts in common but not *all* parts in common. Thus, we have several different complete persons of whom p_7 is a part. This is unproblematic because the relation that I am defining here is more akin to a set membership relation (where a complete person is a set of person-slices) than to an identity relation. Just as the statement “there is a set containing x and y , and there is a set containing y and z ” does not imply that there is a set containing x and z , so my treatment of persons is not contradictory. This lack of transitivity also occurs in membership relations with everyday objects that share parts: a kitchen and a bedroom may share a wall without sharing any of their other parts. The wall and fireplace are

both a part of the kitchen and the wall and bed are both a part of the bedroom, but there is no room which has both the bed and fireplace as parts.

It is interesting that the concept of ‘ x is a psychological continuer of y ’ – which is instrumental in my account of being the same person – is, in fact, transitive. How then do nontransitive cases of being-the-same-person occur? Let x be part of the same person as y and y be part of the same person as z but x not be part of the same person as z . The lack of transitivity in this case can only

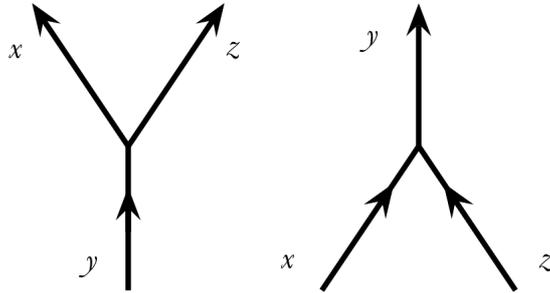


figure 5: *cases of non-transitivity*

occur if x is a psychological continuer of y but y is a psychological *predecessor* of z (or vice versa). This means that x and z are on separate branches, with no path between them that follows the direction of the arrows. It is only in cases where there are separate branches like this (and thus fission or fusion) that the transitivity is lost.

We therefore have an account of personal identity in which two person-slices are part of the same person if and only if they are psychologically continuous with each other and two whole persons are identical if and only if each of the person-slices that make them up has the same properties.

This definition has the advantage of adhering to the ‘only x and y ’ constraint and being transitive, while using a pure psychological continuity account of why it is that two people are identical.

4. Differences in space-time and psychological continuity views

Consider a person, p_1 , who at the age of twenty goes to a teletransporter and undergoes the drugging and scanning, but for some reason cannot be sent, so is not destroyed and just goes home. He then continues life as per normal for another ten years, sticking to conventional travel. One day, due to a computer malfunction, the scanned image from ten years ago is sent to another teletransporter and a copy is formed. We now have the thirty-year-old person, p_{2a} and a twenty-year-old copy, p_{2b} , who are continuers of p_1 .

How would we represent such a case on one of the diagrams that we have been using so far? While it may initially seem that we should split the person at the age of thirty (as this is the time at which the fission occurred), this does not seem to properly

represent the situation. The two continuers of p_1 really diverged at the age of twenty. While it is tempting to think of the diagrams as consisting of some kind of horizontal mind-state axis and a vertical time axis, it really seems that time is not represented by an axis at all. How can this be? What (if anything) do these diagrams represent?

The answer can be seen in a device used in physics called a *phase space* diagram. Consider a frictionless pendulum that is set in motion. This is a deterministic environment, so at any time the future behaviour of the system is determined by its current state. This state need only consist of the position of the pendulum and its velocity. For simplicity, we can just describe its position as its distance to the right of where it would be if it hung straight down. As the pendulum swings, we could observe that it reaches its maximum speed when it is hanging straight down. This happens twice per swing – once while travelling to the left, once travelling to the right. It reaches its minimum speed (of zero) when it is at the extreme right or left. Figure 6 shows a phase-space diagram of this situation.

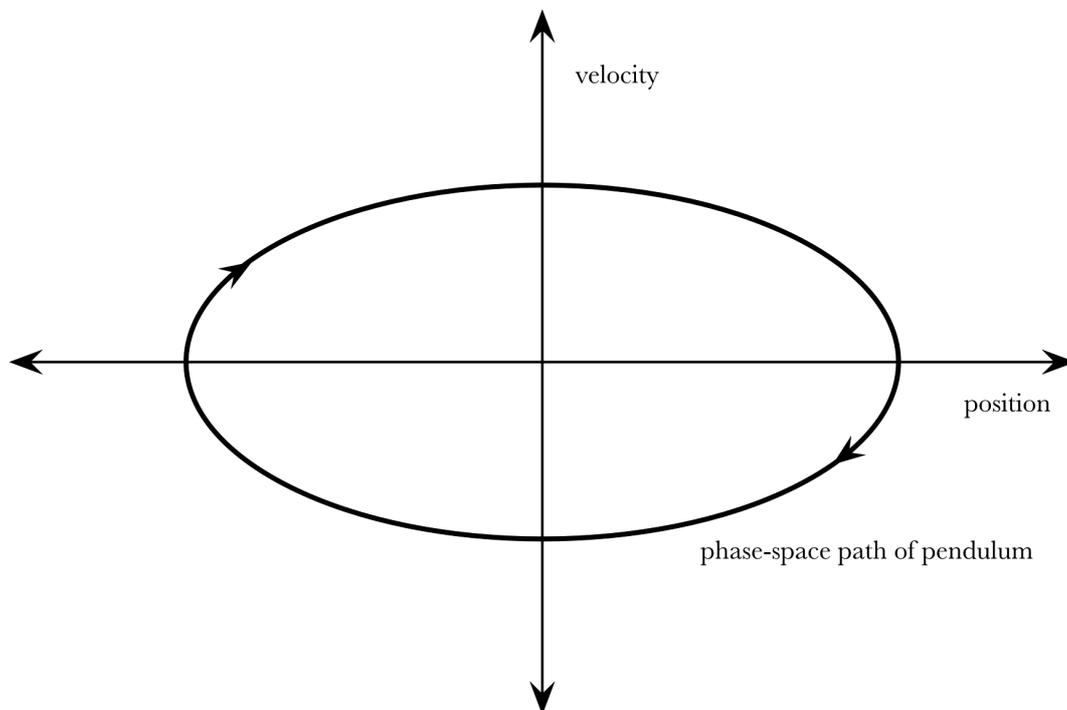


figure 6: a *phase-space diagram*

Each point in this ellipse represents a state that the pendulum system goes through. We can express the order through which the states occur by the arrows on the ellipse. Whereas the lines in the fusion/fission diagrams form a set of person-slices (or mental states) that are psychologically continuous, the ellipse here connects the states of this system that are physically continuous. Time is not a dimension in either diagram, but is still important and is represented by the arrows which show the directionality of the processes.

Therefore, we would represent the case of the forgotten scan with exactly the same (Y shaped) diagram as in the standard fission case. This diagram perfectly captures the psychological continuities of the situation. The time factor is not represented on the diagram, but this is not a problem as the timing does not change the psychological continuity in these cases. By analysing these diagrams, we can see that while the case of the forgotten scan is quite new in a spatio-temporal sense, it is not a new type of case for psychological continuity. This difference between these two views of persons can be used to generate and examine other intriguing cases.

Revisiting the earlier case of a simple teletransportation where an amount of time elapses between the destruction of one person and the forming of another, we can see that the diagram to represent this would simply be a single, continuous line. While there was a temporal discontinuity, there was no psychological discontinuity.

This irrelevance of temporal orderings can manifest itself in other, more extreme ways. Consider a situation such as the (very unlikely) one discussed earlier, where a person was destroyed, but survived through the existence of a randomly generated person who was psychologically continuous. In our new case, imagine that the randomly generated scan-file was generated before the other person was destroyed. Such a case is shown here in figure 7.

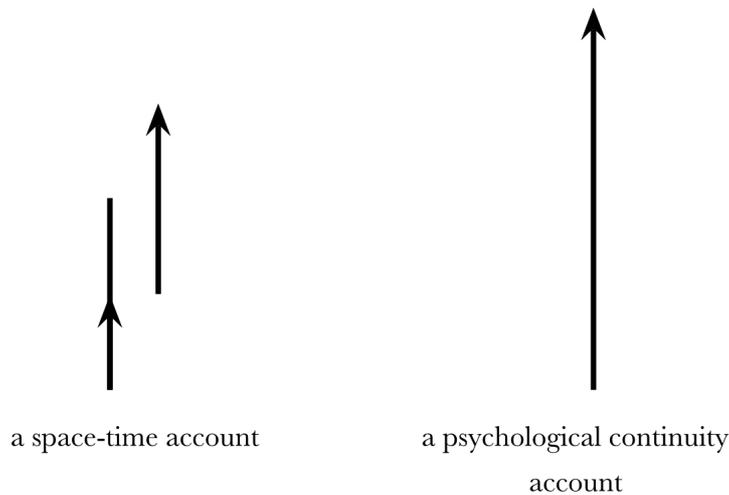


figure 7: *two complementary accounts*

This is a strange result for the psychological continuity account of persons. In cases like this, someone could live a continuous forty-year life in the space of thirty years by living out ten years in parallel.

As an even more extreme example, someone could live out the last years of his life before the first years even begin. A person, p_2 , could be generated in the body of a twenty year old, with the mind of a twenty year old and live for, say, fifty years. Then

a few years after their death a person, p_1 , is born and in twenty years time, happens to (amazingly co-incidentally) end up with a mental state which is identical to that which the earlier person possessed when he was created.

While it would take something like time travel to make such a scenario remotely *likely*, it is certainly a logical possibility and one which the psychological continuity account deals with neatly, even though its results seem very unintuitive at first glance.

5. Probabilistic fission and fusion

There is also an interesting application of the concepts of fusion and fission to accounts of people that involve probability. Imagine a person, p_1 , who doesn't know whether to go to the cinema or to read a book. He decides to flip a (fair) coin and go to the cinema on heads or read a book on tails.

We can consider this to be a type of probabilistic fission. If heads comes up, there will be a person, p_{2h} , who will go to the cinema. If tails comes up, there will be a person, p_{2t} , who will read a book. p_{2h} and p_1 are psychologically continuous and thus part of the same person. This is also true of p_{2t} and p_1 .

Probabilistic personal fission is clearly quite different to the earlier account, but it is also closer to everyday events and provides another use for the theory of personal identity detailed above. In this case, it does not simply explain how to link three-dimensional person-slices into four-dimensional persons, but instead how to link person slices across different physical possibilities *and* times. Thus, p_1 , p_{2h} and p_{2t} are part of a cross-time, cross-possibility person. Although p_1 cannot end up as both p_{2h} and p_{2t} in the same possibility, when we look across all possibilities we see that there is one where p_1 ends up as p_{2h} and one when p_1 ends up as p_{2t} .

This fits in well with models of probability like the many-worlds interpretation of quantum mechanics in which all events with some physical likelihood happen (but not those which are merely *metaphysically* possible). In this case, p_1 does become both p_{2h} and p_{2t} , but in different worlds. Thus, according to the many-worlds interpretation, we continually undergo such fissions – every time a random quantum event occurs. However, because the products of the fission end up in different worlds, they do not meet again[†].

[†] The many-worlds interpretation of quantum mechanics does permit universes to communicate with each other, but only through various sub-atomic phenomena. The emerging field of quantum computing is entirely based upon computers which undergo fission and can share their results.

Being separated from someone is not, however, sufficient reason for neglecting them (especially if they are a future self). Just as in the case where the person who was about to fission to Paris and London would care about both continuers, so we would care about both possible continuers here. This fits with our intuition of weighing up the probabilities of different outcomes before making a choice involving some randomness. It also fits nicely with the intuitions that we would randomly end up as either the Paris continuer or the London continuer.

While the many-worlds interpretation of quantum mechanics is not yet the dominant interpretation, it is a very useful philosophical model of probabilities and forms an interesting bridge between standard personal fission and probabilistic personal fission.

6. Conclusions

We have seen here many strange implications of psychological continuity when combined with teletransportation. While the cases of simple teletransportation, fission and fusion have often been considered as immediately refuting the view of psychological continuity, I have given an account of how psychological continuity can survive these challenges without violating the transitivity of identity or the ‘only x and y ’ principle. In surviving these difficult and varied challenges, the psychological continuity view even suggests that these cases are not merely pathological counter-examples, but important and interesting features of personal identity.

I have also shown several new and interesting cases including causal discontinuities, probabilistic fission and a revised account of fusion, with each case highlighting different and intriguing implications of psychological continuity. My analysis of the types of diagrams used to discuss cases of fusion and fission has shown that these are importantly different to space-time diagrams and that these differences can be used to create new and interesting cases for the psychological continuity view of identity.

While I have only attempted to show that psychological continuity can give plausible answers to its critics, the sheer number of difficult cases that this view sheds light upon provides some positive argument for it. Even if someone were to dismiss psychological continuity for its results in some of these cases, it still has some value as an interesting tool for providing such a wealth of bizarre cases which are of considerable philosophical interest.

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- ¹ B. Brody, *Identity and Essence*, Princeton: Princeton University Press, 1980, p. 7.
- ² Ibid., pp. 49-59.
- ³ Ibid., pp. 20-3.
- ⁴ Ibid., p. 51.
- ⁵ D. Parfit, *Reasons and Persons*, Oxford: Clarendon Press, 1984, p. 213.
- ⁶ S. Shoemaker, *Self-knowledge and self-identity*. Ithaca: Cornell University Press; 1963.
- ⁷ J. Locke, *An Essay Concerning Human Understanding*, London: Everyman's Library, 1961, vol. II, chap. XXVIII, sec. 10.
- ⁸ Parfit. *Reasons and Persons*, p. 205.
- ⁹ D. Parfit, 'Personal Identity', *The Philosophical Review* 80, 1971, pp. 209-11.
- ¹⁰ Parfit. *Reasons and Persons*, p. 262.
- ¹¹ Ibid., pp. 199-201.
- ¹² P. Unger, *Identity, Consciousness and Value*, Oxford: Oxford University Press, 1990.
- ¹³ Ibid., pp. 253-66.
- ¹⁴ H. Noonan, *Personal Identity*, London: Routledge, 1989, pp. 152-4, 235-54.
- ¹⁵ Ibid., pp. 298.
- ¹⁶ Ibid., pp. 262.
- ¹⁷ B. Williams, 'Personal identity and individuation', *Proceedings of the Aristotelean Society* 57, 1956-7. p. 333.