CAUSAL ENDURANTISM

A NEW ACCOUNT OF IDENTITY THROUGH TIME

by

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DECLARATION

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ABSTRACT

This thesis proposes a new account of identity through time. The position, I will call 'causal endurantism', successfully overcomes some well-known objections to two established accounts of persistence. As is well known endurantism faces the problem of temporary intrinsics and the problem of changes in parts, and one form of perdurantism, based on spatiotemporal/qualitative continuity, cannot survive immaculate replacements and rotating disc arguments. Contrary to popular opinion, causal perdurantism also cannot avoid rotating disc arguments because it cannot fix states of motion for homogeneous objects without invoking facts of identity, and thereby becoming circular. The new account proposed in this thesis overcomes all of these problems and shows us that a hybrid account of identity is tenable. As a mixed account causal endurantism is, in some respects, like both endurantism and perdurantism, in that although the distinct successive stages of an object are connected by patterns of causal relations, these stages are not directly causally related but are joint effects of a common cause. That cause is that which endures — a dispositional property, or internal tendency towards continual change.

ACKNOWLEDGEMENTS

To Gwen,

my nan

Table of Contents

Analytic Table of Contents

Il faut (d'abord) durer (One must, above all, endure)

Hemingway

Introduction

The debate about the identity through time of objects continues to perplex many and satisfy few. Some have the strong intuition that there just is no problem, whilst others felt it to be one of the most pressing problems in contemporary metaphysics. Much of that debate is about onus passing and intuition pumping. It has become a prizefight, with endurantism in the red corner and perdurantism in the blue. One task of this thesis is to clarify exactly what the main tenets of each view are — it turns out that this is the only way to keep an accurate score. The second task is to point out that although causal relations have been touted by the perdurantist as a ready fix for certain problems, such as determining states of motion for homogeneous objects, this is not the case. Causation is no help to the perdurantist, and only leads to circularity. The third task is to introduce a new contender.

I take the rival accounts in a conventional sense. Neither of these positions aims to provide an analysis of what it is for an object to exist at a time. Rather they attempt to characterise what it is for an object to *exist at different times*. Endurantism and perdurantism reflect deeply divergent ontological commitments that turn out to be in the most part, incompatible. In introducing these accounts I will use 'persistence', in the neutral sense as merely meaning that something exists at each of two times. In characterising the way in which objects might persist, I will use the terms introduced by Johnston and developed by Lewis, as follows,

... something persists iff, somehow or other, it exists at various times; this is the neutral word. Something *perdures* iff it persists by having different temporal parts, or stages, at different times though no one part of it is wholly present at more than one time; whereas it *endures* iff it persists by being wholly present at a time. Perdurance corresponds to the way a road persists through space; part of it is here and part of it is there, and no part of it is wholly present at two different places. Endurance corresponds to the way a universal, if there are such things, would be wholly present wherever and whenever it is instantiated.

Endurance involves overlap: the content of two different times has the enduring thing as a common part. Perdurance does not.[1]

In the red corner, ... endurance loses two points. One for falling prey to the problem of changes in temporary intrinsic properties and another for failing to account for changes in parts. In the former case, despite desperate efforts the endurantist has not shown that properties can be successfully time-indexed, for disguised relations lurk at every turn. It looks as though objects only have properties derivatively. That is, objects have properties in virtue of the fact that their temporal parts have them — one strike against endurance. In the latter case, the endurantist idea that identity through time is numerical (and therefore symmetrical, reflexive and transitive) leads to contradiction. It looks like identity through time is, as the perdurantist claims, not identity in this strict sense, but is rather some weaker relation or a combination of relations, namely spatiotemporal/qualitative continuity and causation — two strikes against endurance.

In the blue corner, ... perdurance also loses two points. One for stumbling on so-called 'immaculate replacement' examples, and another for not resolving rotating disc arguments. Perdurantism based on spatiotemporal and qualitative continuity cannot provide a sufficient condition for identity through time, and this is shown by immaculate replacement cases. These examples describe objects that display the requisite spatiotemporal and qualitative continuity and yet do not persist through time. So it looks like an account which sees identity through time as a matter of continuity between an object's temporal parts is not feasible — one strike against perdurance. Perdurance that considers causal relations between temporal parts has its own problems. For one, causal perdurantism also cannot resolve rotating disc arguments. Causal

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[1] David Lewis, *On the Plurality of Worlds*, (Oxford: Blackwell, 1986), p.202. This terminology originally appears in Mark Johnston's, *Particulars and Persistence*, (Ph.D: Princeton, 1984), chapters 2 and 5.

relations between temporal parts cannot differentiate between states of motion and stasis in homogeneous objects. Here the perdurantist faces a dilemma; if she does not invoke facts of identity in her solution to rotating disc arguments, relations between temporal parts cannot make this difference. If, on the other hand, she does invoke identity facts in order to make this difference, perdurance falls into circularity. It turns out that no matter what theory of causation is used to flesh out this account, perdurantism built around relations of spatiotemporal/qualitative continuity and causation between temporal parts cannot succeed in this regard — two strikes against perdurance.

Enter the new contender. Causal endurantism is a hybrid account, that takes the best the two heavy weights have to offer, and discards the junk. I argue it is, in essence, Leibniz's account of the identity through time of created substances. The new account sees identity as consisting in the endurance of an active power or force inherent in substances. This internal principle of activity, or 'apperception', is constantly realised and leads substances to continually change. The effects of this enduring force are the phenomenal states of the substance. Causal endurantism differs from conventional endurantism in that it incorporates the notion of immanent causation within substances. However, this causation is not causation in the perdurantist sense. The temporal parts of an object are not connected by the relation of causation, but are related to one another in virtue of the fact that they are joint effects of a common cause, or of one enduring active force. Therefore, causal endurantism has the best of both worlds. It adopts the idea that something endures, or is wholly present, and yet exploits the perdurantist idea that the successive states of a substance are connected by patterns of causal relations, albeit not to each other.

So what is the score? Endurantism and perdurantism each have two demerit points. Causal endurantism can do better. The two problems for endurance evaporate on

this account. The problems of changes in properties and changes in parts, that confront conventional endurantism, do not apply. In answer to these problems, causal endurantism exploits the conventional perdurantist responses. That is, it makes a distinction between an object-proper and the temporal stages of that object. This means that although parts of an object might manifest differing temporary intrinsic properties through time, this is not contradictory. Because two states of an object are distinct effects of an enduring cause, contradiction is avoided. In addition, distinctness between object-stages means that changes in parts does not lead to failure of transitivity. However, causal perdurantism differs from conventional perdurantism two important ways. First, object-stages do not cause one another, but are instead joint effects of a common enduring cause. Second, causal endurantism makes no commitments in regard to the status sums of object-stages. Therefore, causal endurantism avoids two well-known objections to conventional endurantism — no demerit points to causal endurance.

Similarly, objections to conventional perdurance are overcome. In regards to the first, causal endurance provides a sufficient condition for identity where continuity cannot. Two stages of an object will be genidentical if and only if they are joint effects of a common cause, namely a single enduring active force. In the case of rotating disc arguments, causal endurance succeeds where causal perdurance cannot. A real distinction is made between homogeneous objects in motion and stasis because states that are caused by distinct enduring active forces are deemed non-identical. Because a genuine distinction has been made, there is no need to enlist facts of identity. For this reason, the circularity that confronts causal perdurantism is not a threat — a clean record for causal endurance.

Chapter 1: Two objections to endurantism: changes in properties and changes in parts

This chapter is descriptive in character. It outlines two well known objections to endurantism, the problem of changes in temporary intrinsic properties and the problem of changes in parts. The first section (§1.1) consists of an outline of endurantism, or what I will sometimes call the strict account of the identity through time of objects. This outline is intended to be descriptive in character, as the aim is simply to introduce the mainstays of the position in a preliminary manner. The following section (§1.2) presents several reasons that some like to think endurantism is true. While none of these reasons are compelling, they are important as they lead to a better understanding of just what the endurantist claiming. In (§1.3) the first objection to endurantism – the problem of change in temporary intrinsic properties – is examined. In (§1.4) several attempted solutions to this problem are presented, including the time-indexing of intrinsic properties. In (§1.5) another common criticism of the strict account is outlined – that is, the problem of changes in parts which stems from the transitivity of identity. The aim of this chapter is to present two objections to endurantism in order that it might be contrasted with a rival position that will be presented in chapter two.

1.1 Introducing endurantism

In order to introduce endurantism, I want to examine a variety of formulations of the account in order to tease out the main elements of that view. This is not an easy task, as more often than not these elements are not adequately distinguished from one another. However, once we achieve this task, it becomes easier to see just what endurantism commits us to in other areas, particularly in regards to our theory of time. I will argue in

this section that endurantism is 'temporally neutral', and contrary to the opinion of some, does not commit us to a presentist theory of time.

Below, we find a typical statement of endurantism. We can tease four elements out of this characterisation of the position. [2]

[T]he idea of an enduring object is that of an object which is "wholly present" at every single moment of its existence. Ordinary objects are three-dimensional entities which remain in existence even though they acquire new properties from time to time. ... there is a sharp distinction between objects and the processes and events of objects. While events and processes do extend over time by having temporal parts that are numerically distinct from each other, our ordinary objects, on the other hand, can only have spatial parts. Ordinary objects, though existing at different times, persist through time in virtue of being numerically the same object at every time that object exists.[3]

There are four elements to this characterisation. They are that: enduring objects are wholly present; persist not by way of having temporal parts; are numerically identical through time; and lastly, are three-dimensional. I want to examine each of these elements in turn.

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[2] For defences from prominent endurantists see: Roderick Chisholm, *Person and Object*, (La Salle: Open Court, 1976); Peter Geach, 'Some Problems about Time' in his *Logic Matters*, (Berkeley: University of California Press, 1972), pp.302-18; Sally Haslanger, 'Humean Supervenience and Enduring Things', *Australasian Journal of Philosophy*, 72 (1994) pp.339-59; D.H Mellor, *Real Time*, (London: Cambridge University Press, 1981); Trenton Merricks, 'Endurance and Indiscernibility', *Journal of Philosophy* 91 (1994) pp 165-84; Judith Jarvis Thomson, 'Parthood and Identity Across Time', *Journal of Philosophy* 80 (1983) pp.201-220; Peter Van Inwagen, 'Four Dimensional Objects' *Nous* 24 (1990) pp.245-255; P.F Strawson, *Individuals,* (London: Methuen, 1959); and David Wiggins, 'Mereological Essentialism: Asymmetrical Essential Dependence and the Nature of Continuants', in Ernest Sosa (ed.), *Essays on the Philosophy of Roderick Chisholm*, (Amsterdam: Rodopi, 1979), pp. 297-315 and *Sameness and Substance*, (Basil Blackwell, 1980).

[3] Roger Melin, *Persons -Their Identity and Individuation*, (Stockholm: Swedish Science Press, 1998), p.60.

Being 'wholly present'

First is the claim that enduring objects are 'wholly present' at each instant that they exist. By this, the endurantist means that when an object exists at two different times it is wholly present at both of those times. Alternatively, we might say that according to the endurantist a thing is wholly located at each time that it exists, without having a part at one time and a part at the other.[4] This means that an enduring object can be wholly located at both t_1 and t_2 without having a part that is located at t_2 but is not located at t_1, or a part which is located at t_1 but is not located at t_2.[5] On this view, concrete particulars persist by existing wholly and completely at each of several different times. This means that, for any object O expressions such as 'O-at-t_1' and 'O-at-t_2' both serve to pick out a single concrete particular, namely O. This notion is captured by comments such as:

[T]hings are wholly present within their lifetimes.[6]

At any time at which it exists, a continuant is wholly present.[7]

[W]e usually think ...that at any time at which a person exists the whole or entire person exists at that time.[8]

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[4] As Josh Parsons notes in his 'Must A Four Dimensionalist Believe in Temporal Parts?', *Monist* 83 (2000), we must be careful not to confuse being *wholly* located with being *singly* located. Being wholly located is properly contrasted with being partially located, and being singly located is properly distinguished from being multiply located.

[5] Ibid.

[6] Mellor, *Real Time*, p.104.

[7] Peter Simons, *Parts: A Study in Ontology*, (Oxford: Oxford University Press, 1987), p.175.

[8] George Graham, 'Persons and Time', *Southern Journal of Philosophy* 15 (1977) p.309.

Denying temporal parts

The second element contained in the above formulation of endurantism is the idea that enduring objects do *not* persist by way of having distinct temporal parts.[9] This requirement is a natural consequence of the 'wholly present' doctrine. That is, because an object is wholly rather than partially present whenever it exists, it follows that the object cannot have temporal parts. This involves the endurantist's claim that material objects have spatial parts but no temporal parts. This sentiment is expressed as

an object *O* is wholly present at a time, *t*, if and only if all of *O's* parts exist, at that time, *t*.[10]

So endurantism entails the non-existence of temporal parts of objects, or object-stages. This is because the wholly present doctrine just means that if an object exists at a time, it has no other parts that exist elsewhen. Typically, the endurantist will want to draw a sharp distinction between objects and processes or events. Events and processes are said to extend through time by having temporal parts that are numerically distinct from one another. For example, the event that is the reading of this page has temporal extension, in virtue of the fact that it has distinct temporal parts. In contrast, objects are said to only have spatial parts. The page is all here right now. It has no parts elsewhen. This denial of temporal parts leads to characterisations such the following:

Questions of continuity and persistence that perplex our habitual modes of thought about identity and difference ... [need] answers given in language that speaks as simply and directly as natural languages speak of proper three-dimensional continuants - things with spatial parts and no temporal parts, which are conceptualized in our experience as occupying space but not time, and as persisting whole though time.[11]

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[9] The alternative (perdurantism) is just the doctrine that objects *do* persist by way of having distinct temporal parts at different times, and distinct spatial parts at different places. The details of this alternative will form the focus of chapter two.

[10] Merricks, 'Endurance and Indiscernibility', p.181.

[11] Wiggins, *Sameness and Substance* , p.25.

Naturally any talk of temporal parts requires some formalisation of the notion of part-hood. This discussion will take for granted the commonly used concepts that can be drawn from standard theories of mereology and summation.[12]

Numerical identity through time

The third element of the above formulation is the numerical identity of material objects over time. This is just the idea that if a three-dimensional object persists through time, there is a three-dimensional object existing at one of those times which is literally identical with a three-dimensional object existing at the other. The condition is that:

An enduring object O that exists at one time, t, is identical to itself, O, existing at another time, t*.[13]

This amounts to the claim that if an object endures from one time to a later time, say from t_1 until t_2, then there is one object at both t_1 and t_2, and at all of the times in between.[14] Therefore, although it exists at different times an object persists through time by being numerically the same object at every time at which that object exists. Persistence then, becomes the numerical identity of a thing existing at one time with a

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[12] I will follow the standard interpretation of concepts like summation taken from classical mereology, or the 'Calculus of the Individuals' found in Nelson Goodman's, *The Structure of Appearance*, (Cambridge MA: Harvard University Press, 1951), pp.42-51. For a discussion of mereology and some non standard interpretations see Simons', *Parts*.

[13] Merricks, 'Endurance and Indiscernibility', p.166.

[14] This condition is important. It means that there are no 'gappy' persisting objects. That is, there are no objects that are wholly present at each of two times where those times are temporally separated. Note that this condition could prove problematic in some scenarios. For example, it may be advantageous that a theory allows for the possibility of temporally discontinuous persisting objects. However, this possibility (or actuality) is beyond the scope of the present discussion. Nevertheless, we might modify endurantism

thing existing at another time. By numerical identity, I mean the familiar relation that is transitive, symmetrical and reflexive. That is, the relation that satisfies the following formulae.[15]

i. $(x)(y)(z)\{[(x = y) \cdot (y = z)] \supset (x = z)\}$

ii. $(x)(y)[(x = y) \supset (y = x)]$

iii. $(x)(x = x)$

I take these to be immediate consequences of the definition of identity that is captured by Leibniz's principle of the indiscernibility of identicals according to which,

iv. $x = y$ only if every attribute of x is an attribute of y, and conversely.[16]

We can contrast numerical or strict identity with 'loose' or 'popular' identity. This second sense of identity is what we mean when we say of two things that they are the same in some sort of relevant sense or way, but are not strictly speaking the self-same individual. Endurantism requires identity in the numerical sense. It requires that an object at one time be *numerically* identical with itself at another time.

Three dimensionalism

The fourth element of endurantism is 'three-dimensionalism'. This element proves to be notably more difficult to characterise. Taken as a thesis about objects, three-dimensionalism is often seen as being co-extensional with endurantism, or in particular

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such that can accommodate the possibility that there might exist objects which persisting by being wholly present at each of several different times, but which are not wholly present at all the times in between.

[15] Or: i) For any three objects, x, y and z, if x is identical with y and y is identical with z then x is identical with z (transitivity); ii) For any two objects x and y, if x is identical with y then y is identical with x (symmetry); iii) For any object x, x is identical with x (reflexivity). These definitions can be found in Irving Copi, *Introduction to Logic: seventh edition*, (New York: Macmillan, 1986), p.387.

[16] Ibid.

with the doctrine that objects are wholly present whenever they exist. That is, enduring objects are deemed 'three dimensional'. All that is usually meant by this is that objects lack temporal extent and as such are three-dimensional entities that are spread out across the three spatial dimensions. As I have said, the terms 'endurantism' and 'three-dimensionalism' are often used co-extensionally.[17]

However, as Trenton Merricks has shown, we must be careful to avoid equating endurantism with three-dimensionalism, or for that matter perdurantism with four-dimensionalism.[18] Merricks admits that many (including him) interchange the term 'endurantism' with 'three dimensionalism' and 'perdurantism' with 'four dimensionalism'. Nevertheless, the two are not equivalent. For example, there might exist souls that are spread out in time. Such entities might perdure through time by way of having temporal parts but not be four dimensional – in fact these entities would, presumably, fill no spatial region whatsoever. Similarly, there could exist an extensionless point, something that endures, in that it persists by being wholly present, but lacks extension and is therefore *not* extended in the three spatial dimensions.[19] If this way of thinking is correct, the fact that an object endures (or more correctly, persists by being wholly present) is neither necessary nor sufficient for that object's being three dimensional. Despite this fact, I will follow terminological conventions and use the two terms as though they were interchangeable.

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[17] For an example of this conflation see Ned Marksonian's, 'The 3D/4D Controversy and Non-Present Objects', *Philosophical Papers* 23 (1994) pp.243-249.

[18] Trenton Merricks, 'On the Incompatibility of Enduring and Perduring Entities', *Mind* 104 (1995) pp.523-531.

[19] Merricks goes on to entertain the possibility that space might have more than three dimensions. He concludes (rightly) that in such a case, enduring physical objects could be said to have as many dimensions as space has, and perduring ones could be said to have one more than that.

I have briefly discussed four components of endurantism; that objects are wholly present, have no temporal parts, are numerically identical through time and are three dimensional. The first three of these elements are central, or core tenets of the view, however the fourth, (that objects are three dimensional), is not entailed by endurantism. In (§1.2) I will examine one theory of time (presentism), in order to discover whether or not it is entailed by endurantism about objects. We can summarise endurantism like so:

... objects have no temporal parts and last, not by perduring, but by enduring. Enduring objects lack temporal extent and have three dimensions instead of four. If a three-dimensional enduring object lasts from one time to another, then there is a three-dimensional object existing at one of those times which is literally identical with a three-dimensional object existing at another[20]

Reasons to be cheerful

Why might we think endurantism is true? In this section I will present four reasons that we might want to accept endurantism. These claimed advantages of the account are widely criticised, although, the view continues to find favour. These are the arguments from: intuitive appeal, moral responsibility, ontological priority and temporal neutrality. This section will not assess these arguments, but will merely point out why it is that we might find endurantism attractive.

Intuitive appeal

First, endurantists often claim that their account meshes well with our pre-philosophical views concerning identity through time. We have seen that an integral part of endurantism is the claim that objects are numerically identical through time. The intuitive appeal stems from the fact that persistence claims sound very much like claims

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[20] Merricks, 'On the Incompatibility ...', p.525.

about numerical identity. For example, we tend to think that claims such as 'O at t_2 is the same as O at t_1' refer to one, and only one particular. Endurantism goes a long way towards preserving this intuition because of its reliance on the premise that if O persists through time, O does so by enduring, that is by being wholly present at every time in its history. This kind of argument for endurantism occurs in the work of, among others, D.H Mellor. Mellor argues that the temporal part theorist or perdurantist is led into error because she has convinced herself that objects are actually events. However, this is said to be highly counter-intuitive, as

... no one else would say that only temporal parts of Hilary and Tenzing climbed only a temporal part of Everest in 1953. The rest of us think the two whole men climbed the one whole mountain, and that all three parties were wholly present throughout every temporal part of that event. Likewise, when Churchill published an account of his early life, that is what he called it: *My Early Life*. He did not call it 'Early Me', and the silliness of such a title is no mere triviality. ... No one thinks a committee has temporal parts, even though its meetings do, nor that a hailstone has just because it's falling a temporal as well as a spatial part of a hailstorm. Nor do physicists suppose only temporal parts of an electron and a positron are annihilated when the two collide: the whole particles are what collide and thereupon disappear.[21]

It is claimed that endurantism is the only account of identity through time that can preserve this kind of intuition.

Moral responsibility

Mellor offers a second argument in support of endurantism. The claim is that moral responsibility tells us that events have temporal parts, whilst objects do not, and this is shown by the fact that enduring persons are required moral and legal responsibility. We naturally think that in order to hold a person responsible it must be the case that one and the same person has both committed the earlier act, and now stands accountable. For questions of moral or legal responsibility to arise, it is argued, the self-same entity must

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[21] Mellor, *Real Time*, p.105.

be wholly present both when the deed was committed and later, when accountability is at issue. Events however do not, and cannot, satisfy this condition. Therefore events have temporal parts and so are never wholly present at any stage in their history. As Mellor says,

In short, social and psychological events can never be held morally or legally responsible for anything because they always have temporal alibis. [22]

Objects and persons on the other hand, because they are wholly present at each stage in their history, *are* the kind of entities that can be held morally and legally responsible. So, Mellor argues, holding persons morally responsible for their actions is only coherent if it is the case that persons persist strictly through time, by enduring.

Ontological priority

Thirdly, some have argued that enduring objects are ontologically prior to perduring objects.[23] For example David Wiggins claims that when perdurantists speak of momentary entities they must, by necessity employ three dimensionalist language. An entity such as 'this object, O-at-18th-September-2001' is defined by the perdurantist as a set of space-time co-ordinates $<O_1, O_2, O_3, t>$ (where O stands for occupying a space and t stands for the time), such that there is a point occupied on 18th September 2001 by a certain portion of matter which at the 18th September 2001 constitutes this object. The four dimensionalist object is understood as the series of these momentary things. However, argues Wiggins, in order to be able to speak in this way the perdurantist must use three dimensional language to define the momentary entity in question. 'This object' refers to the three dimensional object. It cannot refer to the four dimensional

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[22] Ibid., p.106.

[23] Such as Wiggins, *Sameness and Substance* and Melin, *Persons*, p.64.

object simply because that object is supposed to be the sum of all momentary object-stages. In defining what a temporal part of an object is, it is necessary that we make use of the three dimensional notion of an object. In this sense, stages of objects are abstractions of three dimensional objects, or continuant objects. Wiggins concludes that we must master the three dimensional understanding before we can get to the four dimensional one, as is seen in his remark that:

The definitional priority of the continuant language, in which the construction of four-dimensional counterparts of three-dimensional continuants is founded, is instantly and unreservedly conceded by anyone who candidly adopts it.[24]

Wiggins further claims that if four dimensionalism is to be at all satisfactory, it must be able to translate all talk about three dimensional objects into talk about four dimensional objects. However this will mean that for every predicate F in our ordinary language, there must exist a

true biconditional A↔B such that (1) A was constructed with the help of F and without the help of expressions not belonging to the continuant language itself; and (2) B was constructed from expressions belonging to the four-dimensional language and from no expressions belonging only to the portion of the continuant language that was to be reduced or interpreted.[25]

For example, the predicate 'is walking' cannot be a predicate that is applicable to a stage of a person, simply because walking necessarily takes some time. Wiggins concludes that there simply are not any of the required kinds of biconditionals because the perdurantist is forced to use three dimensional language to talk about momentary instances of things.

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[24] Wiggins *Sameness and Substance*, p.195.

[25] Ibid., p.196. .

In this sense then, the endurance view is conceptually-*cum*-ontologically prior to the perdurance view of objects.[26]

Temporal neutrality

What, if any, consequences has endurantism for our theory of time? We have seen that endurantism is often known as 'three dimensionalism'. To make matters worse endurantism is often confused with the position 'presentism'.[27] This confusion stems from the fact that endurantism about objects is often thought to entail presentism about time. For example, we might think that an object, say this piece of paper, endures in that it is wholly present at each moment that it exists. We might also think that the reason no parts of the piece of paper exist at other times is simply that *there are no other times* in which such parts could exist. In other words, we might think that endurantism is true because there are no times other than the present moment. I want to argue that endurantism does not commit us to presentism and that , in fact, the endurantist can remain temporally neutral. It may be thought that nothing in particular hangs on this, but this is not the case. To see why this is not the case, assume that endurantism does entail presentism, then it seems that the following argument will go through.

P1. Endurantism entails presentism.

P2. Presentism is false.

Therefore, endurantism is false.

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[26] Melin, *Persons*, p.65.

[27] For defences of presentism see: John Bigelow, 'Presentism and Properties', in James Tomberlin (ed.), *Philosophophical Perspectives : Volume 10: Metaphysics*, (Cambridge MA: Blackwell, 1996); Steven Savitt, 'The Replacement of Time', *Australasian Journal of Philosophy*, 72 (1994), pp.463-474, Mark Hinchcliff, 'The Puzzle of Change', in James Tomberlin (ed.). *Philosophical Persepctives: Volume 10: Metaphysics* (Cambridge MA: Blackwell, 1996); David S. Oderberg, *The Metaphysics of Identity Over Time*, (New York: St Martins Press, 1998); George Schlesinger, 'How to navigate the river of time',

The objection is that because endurantism entails a theory that is false it too must be false. I will show that in fact, endurantism is neutral when it comes to theories of time. Contrary to what many might think, the endurantist is free to embrace non-presentism. It is true that the endurantist can be and perhaps more often than not is a presentist, but importantly, she need not be so. The trick here is to see presentism for what it is really is – a thesis about times rather than a thesis about objects. Mind you, that is not the way that presentism is usually presented, for example:

Presentists hold that the only things that really exist are those that exist *now*, at the present moment; and non-presentists believe in something like a 'block-universe' in which non-simultaneous objects and events nevertheless co-exist (in a tenseless or non-temporal sense).[28]

Here we see presentism described as a thesis about objects, rather than one regarding time. However, I want to maintain that presentists say what they do about objects *because* of what they think about time. Characterising presentism proves to be no less difficult than characterising endurantism, however once this is done some common errors are exposed. Presentism can be formulated like so;

Presentism 1: Only the present moment exists.

However presentism is more usually characterised as a thesis about objects, or more specifically as a thesis regarding non-present objects, in the following manner,

Presentism 2: Only present objects exist.

It is clear that presentism 1 entails the truth of presentism 2. If only the present moment exists, then only the contents of the present moment can exist, and since the only contents of the present moment are present objects, only present objects

Philosophical Quarterly 35 (1985) pp.91-92; Quentin Smith, 'The phenomenology of A-time', *Dialogos* 23 (1988) pp.143-153; and Roderick Chisholm, *On Metaphysics*, (University of Minnesota Press, 1989).

[28] Bigelow, 'Presentism and Properties', p.115.

exist. It is precisely *because* other times do not exist for the presentist, that she insists non-present objects do not exist – there is simply nowhen for these non-present objects to be. Presentism is in fact a cluster of views. But fortunately, we can pare down the cluster and get to the heart of presentism. Presentists typically:

a) hold that the present time is, in some way ontologically privileged;

b) maintain that all that exists, exists at the present time;

c) claim that an object only has those properties it exemplifies at the present time, and

d) take tense seriously, or believe in temporal becoming.[29]

I claim that a) or the temporal thesis is the mainstay of presentism. As I have said above the truth of b) that all that exists, exists at the present time is a consequence of a) the fact that the present time is ontologically privileged. I also want to maintain that c) an object only has those properties it exemplifies now, should be seen as a consequence of the presentist's belief in b). The presentist believes that because the only objects that exist, exist now, those objects cannot have properties other than those that they have at the present moment. The derivation of the linguistic thesis d) is another matter – one that is not taken up here.[30]

The point is that at bottom presentism is a thesis about the non-existence of non-present *times* and as such, is essentially a temporal thesis. Endurantism, on the other hand, is a thesis regarding objects. It is for this reason that I maintain that endurantism does not entail the truth of presentism. After all, it is difficult to see why a thesis about objects should commit us to any particular position regarding time itself. Once we see this, it becomes clear that endurantism is conveniently neutral about the

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[29] I borrow this characterisation of presentism from Merricks, 'On the Incompatibility…', pp.523-531.

[30] For an extended discussion of the relation between tensed theories of truth, becoming and presentism see Marksonian, 'The 3D/4D Controversy…'.

nature of time. I take this to be an advantage of the view.[31] We want our theories about objects not to commit us to any particular view about time itself.

I have pointed to a few reasons why we might think that objects endure through time. We saw that an alleged disadvantage of endurantism – that it entails an unpalatable view about time – is misguided. It turns out that the endurantist can be non-presentist when it comes to time. In what follows I will present a bigger problem for the endurantist – the problem of temporary intrinsics.

1.2 Objection (1) The problem of temporary intrinsics

The insistence that objects are wholly present at every time that they exist has led the endurantist into difficulty. For,

if object *o* is wholly present at both *t* and *t*' (*o* at *t* is identical with *o* at *t*'), and *o* has *P* (an intrinsic property) at *t*, but *o* has property *Q* at *t*', where *Q* is incompatible with *P*, then *o* is both *P* and *Q*, given the indiscernibility of identicals.[32]

This is the problem of change, or the problem of temporary intrinsics, and it forms the centre of much of the debate between perdurantists and endurantists.[33] The objection

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[31] It is likely that this feature is shared by perdurantism. For an argument to the effect that neither endurantism nor perdurantism entail commitments about time, see Quentin Smith, 'Personal Identity and Time', *Philosophia* 22 (1993) pp.155-167.

[32] Douglas Ehring 'Lewis, temporary intrinsics and momentary tropes', *Analysis* 57 (1997) p.254.

[33] Classic proponents of the objection include: David Lewis, *On the Plurality of Worlds*, (Oxford: Balckwell); David Armstrong, 'Identity Through Time', in Peter Van Inwagen (ed.), *Time and Cause: Essays Presented to Richard Taylor*, (Dordrecht: Reidel, 1980); Michael Jubien, *Ontology, Modality and the Fallacy of Reference*, (New York: Cambridge, 1993); J.M.E Moravcsik, 'The Discernibility of Identicals', *Journal of Philosophy* 17 (1976), pp.587-98;
and William Lane Craig, 'McTaggart's Paradox and the Problem of Temporary Intrinsics', *Analysis* 58 (1998) pp.122-127. Note that Armstrong calls this objection the 'problem of temporary non-relational properties'. For extended discussions of the objection see; Graeme Forbes, 'Is There A Problem About

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poses this question – How can an object be self-identical at two different times if it possesses different intrinsic properties at those times? It seems clear, so goes the objection, that objects possess temporary intrinsic properties. Further, if an object exists at t_1 and at a later time, t_2, then t_1 and t_2 overlap, that is we can say that they have objects as a common part. But how then can that object be both F and $\neg F$? Surely, this is contradictory. The objection presents this challenge – How are we to give an account of temporal modification that eliminates the contradiction between terms for opposing temporal intrinsics? Or:

The principle and decisive objection against endurance, as an account of the persistence of ordinary things such as people or puddles, is the problem of temporary intrinsics. Persisting things change their intrinsic properties. For instance shape: when I sit, I have a bent shape; when I stand, I have a straight shape. Both shapes are temporary intrinsic properties; I have them only some of the time. How is such change possible?[34]

Lewis sees the problem of temporary intrinsics as one of temporal overlap for objects that undergo intrinsic change. How can an object O be F at t_1 and yet lack F (or be G, where F and G are contrary properties), at t_2, though that same object be wholly present at both times. If FO and $\neg$FO is contradictory, why isn't F$O(t_1)$ and $\neg$F$O(t_2)$ similarly contradictory? Does temporal qualification really make a difference?

Persistence?', *Aristotelian Society Supplement* 61 (1987) pp.137-155; Sally Haslanger, 'Endurance and Temporary Intrinsics', *Analysis* 49 (1989) pp.119-25; Katherine Hawley, 'Why temporary properties are not relations between physical objects and times', *Aristotelian Society Proceedings,* 98 (1998) pp.211-216, Hinchcliff, 'The Puzzle of Change'; Mark Johnston 'Is There A Problem About Persistence?', *Aristotelian Society Supplement* 61 (1987) pp.107-135; David Lewis, 'Rearrangement of Particles: Reply to Lowe', Analysis 48 (1988) pp.65-72; E.J Lowe 'Lewis on Perdurance vs Endurance', *Analysis,* 47 (1987) pp.152-154, 'The Problem of Intrinsic Change - Rejoinder to Lewis', *Analysis* 48 (1988) pp.72-77; Merricks, 'Endurance and Indiscernibility' and Dean W. Zimmerman, 'Temporary Intrinsics and Presentism', in Dean W. Zimmerman and Peter Van Inwagen (eds), *Metaphysics: The Big Questions,* (Cambridge MA: Blackwell, 1998).

[34]Lewis, *Plurality*, pp.203-4.

The problem of temporary intrinsics stands as a general argument to the effect that

change in any of the intrinsic properties associated with a familiar particular is

incompatible with the strict account of temporal persistence. We can formalise the

objection like so:[35]

Where O is a persisting object and time t_1 is antecedent to t_2,

(1) O at t_1 is identical with O at t_2 [assume for reductio]

(2) O at t_1 is bent [premise]

(3) O at t_2 is not bent [premise]

(4) If O at t_1 is identical with O at t_2, then O at t_1 is F if and only if O at t_2 is F

[indiscernibility of identicals]

(5) O at t_1 is bent and is not bent (reductio ad absurdum [(1), (2), (3), (4)])[36]

The problem of temporary intrinsics is formed by analogy with a puzzle

about *de re* modality and the problem of accidental intrinsics. How can we consistently

hold that (i) the actual world is not the only one which really exists, and (ii) objects

have literal transworld identity and can therefore be present at more than one world. If it

is true that objects have accidental intrinsic properties, (i) turns out to be incompatible

with (ii). (ii) is the claim that the same object can be in more than one world, but if this

were the case then two worlds would overlap – that is they would mereologically share

a part. But (i) says that the object has real existence in all those worlds where it exists. If

for a pair of worlds, the object has an accidental intrinsic F at one world but lacks it at

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[35] Following that of Merricks 'Endurance and Indiscernibility', p.168.

[36] According to Oderberg, in his *Metaphysics of Identity Over Time*, p.148, Kant also recognised this as a problem for the endurantist. Kant puts the objection thus; "… if this representation [of time] were not an *a priori* (inner) intuition, no concept, no matter what it might be, could render comprehensible the possibility of an alteration, that is, of a combination of contradictorily opposed predicates in one and the same object …" Immanuel Kant, *Critique of Pure Reason*, (trans.) Norman Kemp-Smith (London: Macmillan, 1933) p.76. (A32/B48).

another (or possesses a contrary property *G*, which implies that it lacks *F*), it is both *F* and ¬*F*. Therefore, so the argument goes, modal overlap leads to impossibility. The analogy is clear. The problem is this – if we believe things can change, we must also believe that one thing can have contradictory properties. I do not want to discuss the merits of this kind of modal/temporal analogy here, although it should be noted that not all see the analogy as justified. My point is that the alleged *reductio* against endurantism will only have force if two assumptions that underlie it are warranted. In what follows I will outline these assumptions. They are, as follows;

Assumption (1) The principle of the indiscernibility of identicals is indispensable. We cannot deny its truth in order to circumvent the problem of temporary intrinsics.

Assumption (2) Intrinsic properties of objects exist and can change.

The indiscernibility of identicals

Firstly, we need to examine assumption (1), or the claim that the principle of the indiscernibility of identicals is indispensable here. This sort of defence might go either of two ways. First, we might think that some other principle is being used in order to formulate our account of persistence. By way of elaboration on this first idea, recall that the above objection is supposed to work under the assumption that Leibniz's Law is true and appropriate in this case. The form of Leibniz's Law relevant here is the indiscernibility of identicals, according to which,

$x = y \rightarrow (F)(Fx \leftrightarrow Fy)$

Or, that if *x* is identical to *y*, then *x* and *y* share all and only each other's properties. Perhaps the problem of temporary intrinsics works from the assumption of a related principle, something like the distinctness of the dissimilar. On this principle, if two objects *x* and *y* differ with respect to their properties, then they are distinct. Or,

$\neg(F)(Fx \leftrightarrow Fy) \rightarrow x \neq y$

It might be that the problem of temporary intrinsics only goes through if it is the case that two individuals that do *not* share all intrinsic properties are *distinct*. This certainly is suggested by other characterisations of the objection, such as:

[Particular] P may be at one temperature during the first phase, another temperature during the second. Things, which differ in their properties, are different things.[37]

This sounds like an invocation of the distinctness of the dissimilar. However, this should not perturb us, for this second principle is entailed by the indiscernibility of identicals. So we can rest assured that it is the indiscernibility of identicals that is doing the work in this objection.

The indiscernibility of identicals comes into play in the problem of temporary intrinsics in another way. The objection works from the assumption that the indiscernibility of identicals is appropriate in persistence contexts. Could the endurantist respond that the principle cannot be applied in this case? One reason for thinking this might be that the view that as the principle only applies in cases of numerical identity, it is not relevant to questions of persistence. That is, we might want to say that questions of persistence do not involve numerical identity, and hence the principle cannot be used as a platform from which to criticise this account of persistence.

But clearly this move is not available to the endurantist. Endurantism springs from the assumption that identity through time is numerical identity through time. If this facet of endurantism were to be marginalised in some way, the essence of the position would be lost. It is imperative for the endurantist that the persisting entity in question be wholly present and wholly identical with itself at different times. It cannot

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[37] Armstrong, 'Identity Through Time', p.68.

be partially identical, for that is the intuition underlying the perdurantist account. What we need to remember is that the objection is the endurantist cannot account for changes in certain properties, because her account rests on an assumption of numerical identity. Nevertheless, we believe that it is possible for familiar concrete particulars to persist through change. Endurantism leads to the denial of the principle of the indiscernibility of identicals, and as this is too great a burden, the account is deemed false. The endurantist cannot deny that the principle is applicable to questions of persistence for the simple reason that her account of persistence has its very basis in what is captured by that principle, namely, numerical or strict identity.

'Intrinsicness' defined

What of the second assumption, that intrinsic properties of objects exist, and change? Is it really the case that there are such things as temporary intrinsic properties? In our original formulation, shape was cast as a temporary intrinsic property. It should be noted here that the proponent of the problem of temporary intrinsics does not need to show that a specific example, such as shape, is in fact an intrinsic property of persons.[38] All she needs is that there exist *some* intrinsic properties and that these be temporary. Clearly, anyone wishing to promote this objection must give some account of what it means to say that a property is intrinsic.

Intrinsic properties are often characterised in terms of a distinction between relational and non-relational properties. We distinguish intrinsic properties, which objects have in virtue of the way they themselves are, from extrinsic properties, which

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[38] Although the question is an intriguing one.

they have in virtue of their relations or lack of relations to other objects.[39] As Lewis puts the point:

Hubert Humphrey has a certain size and shape, and is composed of parts arranged in a certain way. His size and shape and composition are intrinsic to him. They are simply a matter of the way he is. They are not a matter of his relations to other things that surround him in this world. Thereby they differ from his extrinsic properties such as being popular, being Vice-President of the United States, wearing a fur hat, inhabiting a planet with a moon, or inhabiting a world where nothing goes faster than the speed of light.[40]

To be intrinsic is to possess the second-order feature of stability-under-variation-in-the-outside-world. However, this characterisation of intrinsicness is circular.[41] Variation in the outside world just means variation in what the outside world is like *intrinsically*. If this were not the case, every property G would turn out to be extrinsic; for a thing cannot be G unless the objects outside of it are accompanied by a G.

Jaegwon Kim offers another characterisation of intrinsicness. According to this characterisation, G is intrinsic if and only if it is compatible with loneliness: where loneliness is just the property of being unaccompanied by any (wholly distinct, contingently existing) thing. The essence of intrinsicness is that the property should be possessable in the absence of other things.[42]

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[39] Lewis, *Plurality*, p.60.

[40] Ibid., p.199.

[41] This argument is due to Stephen Yablo, 'Intrinsicness', *Philosophical Topics* 26 (1988) pp.479-504. Yablo maintains that the best way to avoid a circular definition is to ensure that our philosophical account of intrinsicness, if possible brings about *de jure* relations between intrinsicness and other notions.

[42] This characterisation does bring about *de jure* relations between intrinsicness and other notions. However, according to Yablo it too gives the wrong results. Loneliness, it turns out, is extrinsic, yet since loneliness *itself* is compatible with loneliness, Kim would have to call it intrinsic too. In their 'Defining 'Intrinsic'', *Philosophy and Phenomenological Research* 58 (1998), pp.333-345, Rae Langton and David Lewis also criticise Kim's account, on the grounds that although loneliness itself is not intrinsic, it can

Lewis is aware of this problem with Kim's 'loneliness' criterion of intrinsicness. Accordingly he adopts a different characterisation, according to which a property G is intrinsic if and only if given any objects x and y with the same natural properties, x is G if and only if y is G.[43]

Current conceptions of what it means to be intrinsic are far from univocal. Nevertheless, I will follow the analysis of that concept, recently advocated by Rae Langton and David Lewis.[44] On this view, a property G is said to be 'basic intrinsic' if and only if G and its negation are non-disjunctive properties independent of loneliness and accompaniment.[45] This makes intrinsic properties those properties that never distinguish between things with the same basic intrinsic properties. On this view, something might have a certain shape even if it were the only thing in the universe, and was unaccompanied by anything distinct from itself. Langton and Lewis's definition of intrinsic is as follows. We can say that property, P is 'independent of accompaniment' if

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belong to something that is unaccompanied. For further discussion of the 'accompaniment test', see: Ted Sider's, 'Intrinsic Properties', *Philosophical Studies* 86 (1996) pp.1-27; and Peter Vallentyne, 'Intrinsic Properties Defined', *Philosophical Studies*, 88 (1997) pp.209-219.

[43] I will not enter into the debate about characterisations of naturalness here. It turns put that all perfectly natural properties are intrinsic, but not all intrinsic properties are perfectly natural. For Lewis on naturalness see his: 'Extrinsic Properties', *Philosophical Studies* 44 (1983) pp.197-200; 'New Work For a Theory of Universals', *Australasian Journal of Philosophy* 61 (1983) pp.343-377; 'Putnam's Paradox', *Australasian Journal of Philosophy* 62 (1984) pp.221-236; and *Plurality*, pp.61-65. For criticisms see Ted Sider, 'Naturalness and Arbitrariness', *Philosophical Studies* 81(1996) pp.283-301. In his 'Intrinsicness' Yablo argues that the characterisation of intrisicness in terms of naturalness is overly *de facto*. If some natural property H should fail to be intrinsic then the account will over-generate, and still class H as intrinsic. Furthermore, even if this situation never actually arises there is, in principle, no reason why theories in any quantum domain might not be forced to count extrinsic properties as 'ground floor' intrinsic (by nonlocality).

[44] Langton and Lewis, 'Defining 'Intrinsic''.

[45] Where an object is 'accompanied' if and only if it coexists with some contingent object wholly distinct from itself.

four different scenarios are possible: something accompanied may have P or lack P,

something unaccompanied may have P or lack P.[46] P is 'basic intrinsic' if,

(1) P is not a disjunctive property, and,

(2) P is not the negation of a disjunctive property, and,

(3) P is independent of accompaniment.

Furthermore, on this analysis two things are duplicates if they have exactly the same

basic intrinsic properties. The impact of this just is that P is intrinsic if no two

duplicates differ with respect to P.[47] So for Lewis intrinsic properties are characterised

as reducing to duplication, where duplication again reduces to naturalness. Armed with

this understanding, we can say an intrinsic property is one that can never differ between

two duplicates (actual or possible).

Since intrinsicness can be spelled out in terms of duplication, so too can the

problem of temporary intrinsics.[48] Let two things be duplicates if and only if they are

intrinsically just alike. This problem of change in this context is as follows. It seems

essential to intrinsic change (for example change in shape, mass or temperature) that an

object O at t_2 is not a duplicate of O at t_1. For if O at t_2 was a duplicate of O at t_1 then it

would have to duplicate in all intrinsic properties. But by hypothesis, this is not the

case. Hence O at t_2 is not a duplicate of the O at t_1. Hence, since everything must be a

duplicate of itself, O at t_1 is not the same object as O at t_2.

In conclusion, we can begin to make sense of the role that intrinsicness

plays in the problem of temporary intrinsics. As I said earlier the proponent of this

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[46] Or, P is 'basic intrinsic iff; 1. It is possible that Px and x is lonely; 2. It is possible that Px and x is accompanied; 3. It is possible that $\neg Px$ and x is lonely; 4. It is possible that $\neg Px$ and x is accompanied.

[47] For criticisms of the Langton/Lewis definition of intrinsicness see Dan Marshall and Josh Parsons', 'Langton and Lewis on 'Intrinsic'' (circulated manuscript), and Yablo's 'Intrinsicness'.

[48] I take this characterisation from Parsons, 'Must A Four Dimensionalist Believe...?.

objection against endurantism must provide an adequate analysis of this concept if the objection is to go through. In my view, some headway has been made in this regard, such that we can make sense of the notion and can assume that we are clear about what we mean when say that an object changes in its intrinsic properties. In addition as I have said we can be assured that the objection hinges on the adoption of the principle of the indiscernibility of identicals.

Some endurantist solutions

In this section, I want to outline some replies to the problem of temporary intrinsics. These replies are first, a temporal theoretic solution, second a series of indexical solutions, third the adverbialist solution and lastly a solution based on an analysis of states of affairs. Later, in chapter two (§2.3) I will discuss another solution, one that is offered by the perdurantist account of identity through time.

A temporal-theoretic (presentist) solution

In his initial discussion of the problem of temporary intrinsics, Lewis considers three possible replies all of which he claims fail. One of these replies relies upon the assumption of a presentist theory of time according to which,

> ... the only intrinsic properties of a thing are those it has at the present moment. Other times are like false stories; they are abstract representations, composed out of the materials of the present, which represent or misrepresent the way things are. When something has different intrinsic properties according to one of these ersatz other times, that does not mean that it, or any part of it, or anything else, just has them - no more than when a man is crooked according to the *Times*, or honest according to the *News*. ... In saying that there are no other times, as opposed to false representations thereof, it goes against what we all believe. No man, unless he at the moment of his execution, believes that he has no future; still less does anyone believe that he has no past.[49]

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[49]Lewis, *Plurality*, p.204.

According to this response the presentist simply denies that all times and their contents exist. The claim is that on such a temporal-theoretic solution, changes in temporary intrinsic properties present, at best, a pseudo problem. The problem is said to arise as a result of an incorrect non-presentist view of time. This is what I will call the response from presentism. The response from presentism amounts to the claim that any apparent contradiction comes from a misguided theory of time. The problem of changes in temporary intrinsic properties assumes that Lewis's present straightness and his future lack of straightness are equally real. However, on presentism they are not equally real. In fact, says the presentist, Lewis is just plain straight, and it is false (now) that he is not. True, Lewis has some tensed properties (such as the property of futurely being not straight). However, this is no more a lack of straightness than is his being possibly not straight.[50] In other words:

The obvious response to this objection is that it rests on a fallacious inference from O's failing to exemplify F at some time other than the present to O's failing to exemplify F. The inference is fallacious because, so this response goes, O exemplifies only those properties that it has at the present time. So, if presentism is true, we can see that the endurantist can easily avoid contradiction in the face of change.[51]

This response is presentist in that it focuses on the claim objects only have the properties they have now, and the reason this is true is that other times (and therefore non-present properties) are not real. The idea here is that if the endurantist adopts a presentist framework rather than a non-presentist one she will be free to claim that changes in intrinsic properties do not lead to contradiction. Lewis may be bent at t_1 and not-bent at t_2, but he is *not* both bent and not-bent *now*. We can, of course, say that he

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[50] Oderberg, *Metaphysics of Identity Over Time*, p.156.

[51] Merricks, 'On the Incompatibility...', p.526. See also Melin, *Persons*, pp.60-63.

will be bent at the future time t_2, but this is no more contradictory than saying of Lewis that he is sixty-one now and will be sixty-two next year.

Nevertheless, the response from presentism comes at considerable metaphysical cost, namely the acceptance of that theory of time. Although it cannot be denied that many criticisms have been made of this position, it is not the task of this thesis to assess the merits or otherwise of presentism.[52] Lewis rejects the response from presentism, with the comment that:

In saying that there are no other times, as opposed to false representations thereof, it goes against what we all believe. No man, unless it he at the moment of his execution, believes that he has no future; still less does anyone believe that he has no past.[53]

Lewis's has not correctly characterised presentism here.[54] This means that his reasons for rejecting the response from presentism are unsatisfactory. That is not to say that there are no better reasons for rejecting the response from presentism. Perhaps the best reason is that as I have already mentioned the endurantist is not required to accept the theory of presentism. A better solution to the problem of temporary intrinsics will be one that does not require the presentist to hold a specific theory of time.

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[52] Criticisms of presentism include; the charges that presentism violates the thesis that truth supervenes on being, (see David Lewis's 'Review of A Combinatorial Theory of Possibility', *Australasian Journal of Philosophy*, 70 (1992) p.219); and that presentism is inconsistent with special relativity, (see Hilary Putnam's, 'Time and Physical Geometry', *Journal of Philosophy* 64 (1967) pp.240-247).

[53] Lewis, *Plurality* p.204.

[54] A point recognised by others such as Zimmerman, in his 'Temporary Intrinsics and Presentism'. Presentists do *not* claim that other times are 'false stories'. Rather, the claim is that other times are not real *now*. Past times were real, when they were present, and future times will become real when they become present. The presentist does not reject the existence of other times, she simply does not believe that all times exist simultaneously. When a thing has an intrinsic property at a present (then) but non-present (now) time, it really has that property. That is, when a thing becomes F tomorrow, it becomes F

Indexical solutions

Lewis examines another response, according to which,

... contrary to what we might think, shapes are not genuine intrinsic properties. They are disguised relations, which enduring things may bear to times. One and the same enduring thing may bear the bent-shape relation to some times, and the straight-shape relation to others. In itself, considered apart from its relations to other things, it has no shape at all. And likewise for all other seeming temporary intrinsics; all of them must be reinterpreted as relations that something with an absolutely unchanging intrinsic nature bears to different times. The solution to the problem of temporary intrinsics is that there aren't any temporary intrinsics.[55]

Here Lewis is discussing only one of two related responses to the problem of temporary intrinsics. The first is that outlined in the above passage. It is a strategy according to which non-essential properties, including intrinsic ones, are seen as relations to times.[56] This means that no object O, ever strictly speaking simply has a property F. Rather, O stands in the being-F relation to a certain time t. So this response asks us to reinterpret – 'at t_1, O has F, but at t_2 O has G' in terms of relations to times. O stands in the F-at relation to t_1 and the G-at relation to t_2, where standing in the F-at relation to one time is not incompatible with standing in the G-at relation to another time. If Lewis is bent at t_1 and straight at t_2, he stands in the bent-at relation to t_1 and the straight-at relation to t_2.

The key to this response is not merely the fact that a property has been redefined as a relation. If this were the case the endurantist would remain in difficulty for it is no less problematic to claim that Lewis stands in two incompatible relations to the same object or time. The force of this reply in fact stems from the fact that the relations involved differ with respect to their time *relata*. This difference is said to

tomorrow, and not today. In addition, no presentist will deny that we have a past and a future. Rather, the presentist claims that I do not have a past or a future *now*.

[55] Lewis, *Plurality*, p.204.

[56] A view defended by, Van Inwagen in his 'Four Dimensional Objects'.

dissolve any contradiction. Returning to formalisation of the problem of temporary intrinsics introduced earlier, we can clearly see the strategy underlying this response. Below is the problem of temporary intrinsics, reinterpreted in terms of the response from relational properties (represented as n*).

Where O is a persisting object and time t_1 is antecedent to t_2,

(1) O at t_1 is identical with O at t_2 [assume for reductio]

(2) O at t_1 is bent [premise]

(2*) O stands in the 'bent at' relation to t_1

(3) O at t_2 is not bent [premise]

(3*) O does not stand in the 'bent at' relation to t_2.

(4) If O at t_1 is identical with O at t_2, then O at t_1 is F if and only if O at t_2 is F [indiscernibility of identicals]

(5) O at t_1 is bent and is not bent (reductio ad absurdum [(1), (2), (3), (4)])

(5*) O stands in the 'bent at' relation to t_1, but not to t_2.

The problem, it is said, can be reinterpreted in this way such that the apparent contravention of the indiscernibility of identicals is diffused. I want to leave the relation to a time response at this point, in order to examine a related, although slightly different response.

Lewis considers and rejects a slightly different approach to the problem of temporary intrinsics, according to which we simply,

... say how very commonplace and indubitable it is that we have different shapes at different times. To say that is only to insist - rightly - that it must be possible somehow. ... bent-on-Monday and straight-on-Tuesday are compatible because they are 'time-indexed properties'[57]

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[57] Lewis, *Plurality*, p.204.

This strategy draws on the intuition that if we relativise properties to times any alleged contradiction will be avoided. Although this response is frequently framed in terms of relativised properties, we can relativise in other ways.[58] For instance, we might relativise on the subject, or perhaps the copula – that is, on the instantiation relation itself. How can we decide just where we should place the temporal operator? Consider these options:

1. a is F-at-t (relativise on the predicate/property);

2. a-at-t is F (relativise on the subject/object);

3. a is-at-t, F (relativise on the copula/instantiation relation).

The first option is that which Lewis outlines in the above passage. According to this response, an object exemplifies the time-indexed property of being-F-at-t. The response continues with the claim that there is, of course, no contradiction in saying a single object exemplifies both being F-at-t_1 and not being-F-at-t_2. Below is the problem of temporary intrinsics reinterpreted in terms of the response from temporal indexing (represented as n**).

Where O is a persisting object and time t_1 is antecedent to t_2,

(1) O at t_1 is identical with O at t_2 [assume for reductio]

(2) O at t_1 is bent [premise]

(2**) O exemplifies the property of 'being bent at t_1'

(3) O at t_2 is not bent [premise]

(3**) O does not exemplify the property of 'being bent at t_2'

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[58] In his *Real Time* Mellor asks that we take the first of these options. He argues there that we see properties as relations to times, that is, that we relativise on the property.

(4) If O at t_1 is identical with O at t_2, then O at t_1 is F if and only if O at t_2 is F

[indiscernibility of identicals]

(5) O at t_1 is bent and is not bent (reductio ad absurdum [(1), (2), (3), (4)])

(5**) O exemplifies the property of 'being bent at t_1', but does not exemplify the

property of 'being bent at t_2'.

So what do we make of time indexing? For some, this kind of response

takes the intrinsicness out of intrinsic properties Being bent 'with respect to' begins to

sound suspiciously like an extrinsic property. Recall, extrinsic properties of objects are

defined as those properties that are not matter of that object's relations to other things.

Lewis rejects the response from temporal indexing for just this reason. The endurantist

who claims that properties are relations to times is denying that there are any temporary

intrinsic properties. For Lewis:

This is simply incredible, if we are speaking of the persistence of ordinary things. (It might do for the
endurance of entelechies or universals.) If we know what shape is, we know that it is a property not a
relation.[59]

Lewis may think that he knows what shape is, but not all concur.[60] He is claiming that

this response does violence to our intuitions about what we think are the intrinsic

features of an object (in this case, shape). We just do not think that all properties are

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[59] Lewis, *Plurality*, p.204.

[60] For example Mellor, *Real Time*, p. 113, Mellor argues that nothing much is entailed by seeing properties
as relations to times, except that when such properties are ascribed to a thing, a time must be supplied, or
understood in order that the ascription is either true or false. Furthermore, this truth of ascription does not
depend on how the thing or time is specified because O is F at t_1 and $\neg O$ is F at t_2 are referentially
transparent. Mellor also claims that for O is F at t_1 to be true, O and t_1 must exist.

relations (to times or to anything else). Merricks expresses Lewis's worry with the comment:

But it is not the case that all of the properties that an object seems to gain or lose are really relations to times or time indexed. A short list of those properties which are not – they are known as "temporary intrinsics" – includes shape, colour, size and mass.[61]

Lewis argues that the idea that temporary intrinsic properties are actually relations is just too counter-intuitive to warrant serious consideration, and actually amounts to denying the existence of intrinsic properties altogether. If intrinsics turn out to be disguised relational properties, our common-sense notion of the intrinsicness of properties such as heat, charge and mass is simply false. Parson's makes the point that likely as not, when faced with losing the intrinsicness of such properties, we might want to give them up altogether. It might turn out that no intrinsic properties at all is preferable to disguised external relations. However, this is just the endurantists' point. Intrinsic properties do *not* warrant the name. They are it is said, disguised relations to time – and we should get used to the fact.[62]

Lewis's objection to time indexing is that it will mean that there are no truly intrinsic properties. But surely this will depend upon how far we are willing to stretch the meaning of the term. It might be that we are not required to abandon intrinsic properties if we have time indexing. Rather, we might attempt to modify our concept of intrinsicness.[63] We might, for example choose to say that analysis based on time indexing implies that duplicates, (or objects that share all their intrinsic properties), which exist at different times *do not* share all of their intrinsic properties. The time

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[61] Merricks, 'On the Incompatibility...', p.528.

[62] For a defence of time indexing of properties see Mellor, *Real Time*, p.111.

[63] A move discussed and criticised by Johnston in his 'Is There A Problem About Persistence?, p.113.

indexing analysis might also imply that during any period of time when an object undergoes no qualitative change, it nevertheless will have changed its intrinsics. One thing is certain, time indexing of properties will require, at the very least, that we revise our notion of intrinsicness.[64]

What are the ramifications of revising our concept in this way? I have already said that, on this analysis, temporal duplicates or objects that share all intrinsic properties, (but exist at different times), would actually *not* share all their intrinsic properties. True, they would share the majority of intrinsic properties, but not those that involve their relations to times. This revision implies that during a period of time when an object undergoes no qualitative change, it will have nonetheless changed its intrinsics.

But this will mean that the time indexing of intrinsic properties will exclude the possibility of non-simultaneous duplicate objects (or temporal duplicates). Temporal duplicates become impossible due to the fact that if intrinsic properties are relations to times any would-be duplicate of an object O at a different time, will necessarily have different intrinsic properties from those had by O. This is because, on our revised concept, objects at different times have different intrinsic properties in virtue of the fact that they exist at different times. This idea is counter-intuitive to say the least, if for no other reason than

... if we have two exact duplicates, then no matter how different their respective environments, including their spatio-temporal environments, they will share all their intrinsic properties. Duplicates existing at wholly different times are as much duplicates as duplicates existing at the same time.[65]

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[64] As was said earlier, in my view some important headway has been made in regards to the analysis of our concept of intrinsicness. For this reason, revising our concept might prove to heavy a burden to shoulder.

[65] Johnston, 'Is There A Problem About Persistence?, p.113.

Our intuitions tell us that two intrinsic duplicates do not become non-duplicates just because we take account of times. Interestingly, our intuitions in this regard are closely tied with our views about the nature of properties. For example, it has been argued that if properties are taken to be universals, time indexing will inevitably turn properties into relations as Lewis claims.[66] However, if we see properties as tropes rather than as universals, there is no such outcome. To explain – perhaps F-at-t_1 picks out a non-relational, but time indexed universal. However, this does not sound right. Times are particulars, and universals through their very nature are universal. For example, if we attempt to time index a universal such as 'bent' we must also be positing a universal relation, something like 'bent-at' with two argument places for particulars, one for objects and another for times. If properties are construed as universals, time indexing will lead to an additional argument place for times, (which will always turn the universal in question into a relation), and Lewis's criticism of time indexing will go through. If, on the other hand, we see properties as tropes, time indexing will not turn properties into relations as Lewis claims.

As particulars tropes cannot be wholly present in wholly distinct spatial locations. Most trope theorists maintain that tropes are momentary.[67] This has the consequence that tropes are individuated by times, and therefore are not able to be wholly present at more than one wholly distinct time. If we see intrinsic properties as momentary tropes, we can time index without reducing properties to relations. Therefore:

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[66] For a fuller treatment of this argument see Ehring, 'Lewis, temporary intrinsics …', p.255.

[67] In chapter five I discuss Douglas Ehring's alternative account, according to which tropes persist through time.

Time indexing does not by its very nature generate a relational view even though that is the result when properties are taken to be universals. Times can, in a sense, be built into tropes because tropes are particulars, like the temporal parts of objects, not universals.[68]

If properties are momentary tropes, Lewis's objection to time indexing will not go through since momentary intrinsic tropes are not relations to times. In addition, seeing properties as momentary tropes provides a solution to the worry about intrinsic duplicates. For the trope theorist duplication is not cashed out in terms of the literal sharing of properties. Rather the trope theorist will claim that duplication is a matter of non-identical objects exactly resembling each other in all their non-relational tropes. No tropes can be shared since tropes *qua* particulars cannot be shared. Temporal duplicates are therefore possible because they consist of non-identical objects, existing at wholly distinct times, that resemble each other in all their non-relational tropes.[69] In conclusion, Lewis' criticism of time indexing is unsatisfactory, as the time indexing of momentary tropes will *not* reduce all properties to relations, and will allow the possibility of temporal duplicates.

Again, this solution comes at considerable metaphysical cost. This solution is only successful if it turns out that properties are tropes rather than universals. The endurantist might want to deny trope theory on other grounds. In my opinion it is plausible that our theory of identity through time should not exclude the possibility that properties are universals. For this reason, even if momentary tropes *can* be time indexed without turning intrinsics into relations to times, this solution is too restrictive.

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[68] Ehring 'Lewis, temporary intrinsics ...', pp.255-6.

[69] Although this argument is originally due to Ehring, note that, for him, the argument is purely academic. Ehring actually holds that *not* all tropes are momentary. The implications of his theory of persisting tropes will be the subject of chapter five.

Finally, if we allow the temporal indexing of properties such as shape, mustn't we apply it to *all* of an object's properties. The claim is that the endurantist cannot pick and choose which of *O*'s properties should be time-indexed simply in order to preserve the principle of the indiscernibility of identicals. Surely, we want to say that *O* has some properties *simpliciter*, which do not admit of time indexing.[70] Some time indexers have responded to this of argument in the following manner. Put simply the appeal to time indexed properties, in order to dissolve the problem of temporary intrinsics, does not preclude properties that are *not* time indexed.[71] Just because some properties are properly time indexed, this does not mean that all are. However this move is plainly ad hoc. If we *do* decide to time index, we should do it unequivocally. But by the same token, Lewis's assertion that 'an object must have some properties *simpliciter*', is exactly what the time indexer denies, namely that properties are instantiated without being had at a time. I leave resolution of this intuition stalemate to others.

1.3 Objection (2) The Russell-minus objection

This brings us to a second criticism of endurantism. It is an objection that, like the problem of temporary intrinsics centres on change, but focuses on changes in *parts* rather than changes in properties.[72] The objection begins with the observation that objects constantly change in terms of their parts. The page continually loses and gains

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[70] Lewis, *Plurality*, p.202-5.

[71] Merricks, 'Endurance and Indiscernibility'.

[72] For a clear expositions of the objection see Michael J. Loux's *Metaphysics: a contemporary introduction*, (London: Routledge, 1998), pp.222-231 and Mark Heller's, *The Ontology of Physical Objects*, (Cambridge: Cambridge University Press, 1990), pp.2-4, 19-20.

fundamental particles. However, we also believe that the page persists through these changes. So what is the objection here?

Consider Russell, as he was at a certain time, *t*. Before *t* Russell was fully intact, let's say, he had a left little finger. Call this 'Russell-before-*t*'. We can assume that if Russell existed before *t*, then so did something else, which we can call 'Russell-minus'. This earlier familiar object, 'Russell-minus' consists of all of Russell, except his left little finger. 'Russell minus-before *t*' is the name that we give to the object which is Russell-minus as it existed before *t*. We now assume that at *t*, Russell loses his left little finger. Call this new object 'Russell-after-*t*'. Now, we believe that a thing can survive the loss of some of its parts. The page persists, despite the loss of a few electrons. However, according to the endurantist survival is a case of *strict* numerical identity. This means that the endurantist is committed to the claim that (1) Russell-before-*t* is numerically identical with Russell-after-*t*.

But we know that both Russell and Russell-minus survive the loss of the said left little finger. Furthermore, we believe this to be the case despite the fact that Russell's left little finger is not attached to Russell-minus. The endurantist will interpret the survival of Russell-minus as another case of strict numerical identity. That is, the endurantist will maintain that Russell-minus-after-*t* is numerically identical with Russell-minus as it exists after the loss of the little finger. So, the endurantists is also committed to the claim that (2) Russell-minus-after-*t* is numerically identical with Russell-minus-before-*t*.

But now the endurantist is committed to the existence of two objects, namely Russell-after-*t* and Russell-minus-after-*t*. How is the relation between these two objects to be characterised? To begin with, they clearly occupy the same region of spacetime and they are composed of exactly the same matter. So Russell-after-*t* and

Chapter 2: An objection to perdurantism: the inadequacy of continuity

The task of this chapter is to introduce, in some detail, the rival position to endurantism, known as perdurantism. Broadly speaking, perdurantism is the position according to which objects persist through time by way of having appropriately connected temporal parts. Perdurantism comes in two forms. The first is based on the idea of continuity, both spatiotemporal and qualitative. The second appeals to causal relations between temporal parts.[74] This chapter begins with a characterisation of the broader position, perdurantism (§2.1). Section (§2.2) includes a more detailed discussion of this broader position, and explores some of the worries that the perdurantist must face. The following section (§2.3) contains a brief discussion of a solution to the problem of temporary intrinsics, which is generated by the perdurantist account of persistence. Here, we will see that a more detailed analysis of the position is sufficient to put such worries to rest. Following this is (§2.4) an account of the perdurantist's response to the problem of changes in parts will be outlined. Finally, (§2.5) sees an exposition of the first variant of perdurantism – a position referred to as the spatiotemporal and qualitative continuity account of identity or SQC. This final section contains an argument for the view that SQC is neither necessary nor sufficient for identity through time. This paves the way for the discussion of chapter three, which includes the outline of a second problem for SQC and the introduction of the second variant – causal perdurantism.

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[74] A discussion of causal perdurantism follows in chapter three.

2.1 Introducing perdurantism

Perdurantism involves at least three main claims.[75] First is the claim that identity through time is not a matter of strict or numerical identity. Rather, identity through time is, in Bishop Butler's sense, a matter of loose or popular identity. Second, objects persist by way of having temporal parts. Third, is the claim that space is analogous to time, which is just the commitment to four dimensionalism.

Loose and popular identity

According to this account objects are successions of events, temporal parts, or object-stages. Assertions of identity through time are not assertions of literal identity. This is in direct contrast with the endurantist tenet that identity through time just is numerical identity. The perdurantist will maintain referring expressions such as 'O at t_1' and 'O at t_2' do *not* pick out a single particular. Rather, the two expressions refer to numerically distinct parts, stages, or slices of a much larger single particular. So rather than being a single particular, an object is an aggregates of temporal and spatial parts.

Temporal parts

Contrary to the endurantist, the perdurantist denies that concrete particulars persist just in case they exist wholly at a time. Recall Lewis's definition, as stated in chapter one:

[S]omething persists iff, somehow or other, it exists at various times; this is the neutral word. Something perdures iff it persists by way of having different temporal parts, or stages, at different times though no

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[75] Perdurantism has been advocated by, amongst others: David Hume *A Treatise of Human Nature*, L.A Selby-Bigge (ed.), as revised by P.H Nidditch (Oxford: Oxford University Press, 1978); Lewis, *Plurality*; John Perry, 'The Same F', *Philosophical Review*, 80 (1970); and W.V.O Quine, *Word and Object*, (Massachusetts: MIT Press, 1960), p.171.

one part of it is wholly present at more than one time … Perdurance corresponds to the way a road persists through space; part of it is here and part of it is there, and no part of it is wholly present at two different places.[76]

For the perdurantist, objects persist in virtue of the fact that they have parts which exist at different times. Objects persist in virtue of the existence of a sequence of related, but non-identical, temporal segments of that object. This means that for any ordinary persisting object O, it is true that O is an aggregate composed of the series of temporal parts $<O_1, O_2, ..., O_n>$ where each temporal part of O is distinct from O and from every other temporal part of O.[77]

But what exactly are these temporal parts? Lewis is quick to point out that temporal parts are, of course also spatial. They are the parts of an object that take up *all* of the spatial region occupied by that object, but only *part* of the temporal region filled by that object. Conceptual analysis of temporal parts can prove difficult.[78] For example, there at least three ways that we might want to think about temporal parts. First, we might say that a temporal part of an object through a certain interval of time is just the ordered pair consisting of that object and that time.[79] So the 2001 temporal part of this page is just the ordered pair consisting of 2001 and the page. Second, we might say that a temporal part is an event, where objects such as pages and pencils are relatively long

[76] Lewis, *Plurality*, p.202.

[77] Melin, *Persons*, p.55.

[78] For a good discussion of these difficulties, see André Gallois in his *Occasions of Identity*, (Oxford: Clarendon, 1998), pp.255-256.

[79] This approach is favoured by: John Pollock in his *Language and Thought*, (Princeton: Princeton University Press, (1974); and Sydney Shoemaker's *Identity, Cause and Mind: Philosophical Essays*, (Cambridge: Cambridge University Press, 1984). In his *Occasions of Identity*, p.256 Gallois argues that the first conception, which takes temporal parts as being ordered pairs, will not yield the answers we want to certain problems of diachronic identity.

events.[80] Third, we might want to say that objects are not events. Rather, a temporal part

of a page is a page, or at least a page-like entity with a brief lifespan.[81] I will follow this

third conception of temporal parts, according to those parts are object-like. The page at t

is as much a page as the extended object which exists from the time of the page's

creation up until the time of its demise. It is helpful to think of temporal parts as being

of the same type as the objects of which they are parts.

According to the perdurantist, identity through time consists in the holding

of relations of an appropriate kind between temporal parts, existing at different times.

So, for the perdurantist, objects are aggregates of spatial parts, (these bits and those

bits), and temporal parts, (the object five minutes ago, the object five weeks ago and so

on). All of these temporal parts are connected such that they form a persisting whole. I

want to gloss over the *manner in which* temporal parts are connected at this stage. The

nature and implications of this connection will become the focus of a later section. The

important thing to take account of is the fact that perdurantism carries an implicit thesis

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[80] An approach taken by: Andrew Brennan 'Reply to Garrett's Reply to 'Best Candidate Theories and
Identity', *Inquiry* 31 (1988) pp.87-92; C.D Broad, *An Examination of McTaggart's Philosophy Volume I*,
(Cambridge: Cambridge University Press, 1933); Mellor, *Real Time*; Quine, *Word and Object*, and
Simons, *Parts*.

[81] Perhaps the most popular conception, favoured by: Lewis, *Plurality*; Mark Heller, 'Things Change',
Philosophy and Phenomenological Research, 52.3 (1992) pp.695-704; Paulo Dau, 'Part-Time Objects' in
Midwest Studies in Philosophy, volume9 (1986) pp.459-474; and Thomson 'Parthood and Identity Across
Time'. Gallois argues that adopting this third conception – that is - seeing temporal parts as object-like,
will allow us to say what it is for a table to have, say, a red top at t. A table has a red top at t if the t *part*
of the table has a red top. We can say this precisely because the t part of the table *is* a table (or at least a
table-like entity). If, on the other hand, we see temporal parts as events, argues Gallois, it becomes
difficult to see how this can be so – as events just do not have red tops. This third conception is
controversial however. For starters, it is not obvious that any table that exists throughout t has a part
whose lifespan is confined to t. However despite this, Gallois maintains that we should adopt this third
conception because it is helpful in the cases of identity puzzle-cases with which he is concerned.

of aggregation.[82] Familiar objects are not unities, but aggregates of spatial and temporal parts. This implies that ordinary objects are aggregates whose composing parts are temporal parts of the objects. Or:

Familiar concrete particulars are aggregates of temporally smaller items; and their persistence through time consists in the existence of those temporally smaller items at different times.[83]

This thesis of aggregation amounts to the denial of the endurantist view that objects persist just in case they exist wholly at a time. Rather, objects are said to persist in virtue of the fact that they have parts which exist at different times. An object is only partially present at any given time, and is never wholly present. This is because, for the perdurantist, objects understood as these extended aggregates are just too large - temporally speaking - to be wholly present at one time. So:

The thing that persists through time (me, say) is the sum or composite of the several distinct things each of which occupy just a single one of the times I am located at. These things, my temporal parts, or time-slices, are located at just one of the times at which I'm located (while I am located at many).[84]

On this view, an object is multiply located, but this is so in virtue of some other things being singly located (the parts). This means that for any persisting object that is multiply located at t_1 and t_0, this is so in virtue of there being some other things that are singly located at t_1 and t_0, namely that object's parts.

The perdurantist sees extension through time as analogous to extension through space. Just as an object has spatial parts, so it has temporal parts. The thesis of temporal parts rests on the assumption of an analogy between spatial and temporal

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[82] See Lewis in his 'The Paradoxes of Time Travel', *American Philosophical Quarterly*, 13 (1976) p.22 for a discussion of objects understood as aggregates.

[83] Loux, *Metaphysics* , p.207.

[84] Parsons, 'Must A Four Dimensionalist Believe...?'.

parts. That is, the temporal part-whole relation of persisting objects is understood in

analogy with the spatial part-whole relation of ordinary physical objects as they are at a

certain time t. For example, a chair C existing at time t is said to be composed of the

spatial parts, the seat of C, the back of C and so on. In the same way, the chair persisting

from t_1 until t_2 consists of the temporal parts, C at t_1, C at t_2 and so on. In other words, a

temporal part of the chair is the relativisation of the chair to a particular time t, or a

particular time interval $< t_1, t_2 >$ where the chair at time t_1, or at the time interval are

numerically distinct entities from both the chair and the other temporal parts of the

chair.[85] For the perdurantist, objects extend through time in virtue of the fact that they

have parts that exist at each time, just as objects extend through space by way of having

parts located at each of those places it takes up.

      Some object to the concept of a temporal part. The objection stems from the

fact that we can have different conceptions of temporal parts. For example, because

temporal parts persist through time, they can themselves be understood as processes,

events or careers of objects. Then we have an extended time-sequence of an object. Or,

on the other hand temporal parts might be thought of as momentary objects, to be taken

as the way things are *at* a time, or at a space-time point. Then it seems that a temporal

part is a momentary time-slice of an object. This is an ongoing debate. Whitehead

maintains that *all* parts of objects have some duration, that is - none are instantaneous.

This means that all parts of a four-dimensional object are themselves four-

dimensional.[86] Others defend the existence of instantaneous temporal parts.[87] However,

ultimately these matters hinge on one's concept of time itself rather than one's account

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[85] Melin, *Persons*, p.55.

[86] Alfred North Whitehead, *The Concept of Nature*, (Cambridge: Cambridge University Press, 1920), p.56.

[87] For example Heller, *The Ontology of Physical Objects*, pp. 4-6.

of persistence.[88] It may be that some temporal parts are momentary, or instantaneous, whilst others are extended, but this does not change the perdurantist point. That point is just that persistence is to be analysed in terms of the relation between temporal parts.

Four dimensionalism

I have said that one assumption underlying perdurantism is the idea that spatial parts of an object are analogous to temporal parts. The majority of perdurantists subscribe to four dimensionalism.[89] However, just as endurantism does not entail presentism, perdurantism does not entail four dimensionalism.[90] Four-dimensionalism is a thesis regarding the spatial and temporal dimensions. Time is understood as an additional dimension and objects are the entities that fill a region in space-time.[91] For the four dimensionalist reality is spread out in time as well as in space. Just as objects that are located at multiple regions of space contain parts confined to those regions of space, so objects that are located at multiple regions of time contain parts - temporal parts - that are confined to those regions of time. The four dimensionalist will usually

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[88] Merricks, 'On the Incompatibility...' argues that questions of persistence do not ride on theories of time.

[89] Some avid four dimensionalists include: Brennan 'Reply to Garrett's...'; Nancy Cartwright 'Causal laws and Effective Strategies', *Nous* 13 (1975) pp.419-437; Heller, 'Things Change'; Lewis *Philosophical Papers Volume I*, (New York: Oxford University Press, 1983), *Philosophical Papers Volume II*, (New York: Oxford University Press, 1986); Quine, *Word and Object*; Shoemaker *Identity, Cause and Mind,* and *Personal Identity*, (Oxford: Blackwell, 1984); and J.J.C. Smart 'Spatialising Time', *Mind* 64 (1955) pp.239-241.

[90] D.H Mellor is an example of a three dimensional perdurantist.

[91] See Mark Heller's 'Temporal parts of four-dimensional objects', *Philosophical Studies* 46 (1984) p.325 for a good discussion of this point.

identify ordinary continuants with 'space-time worms' - or mereological sums of stages from different times.[92]

The core of four dimensionalism is what can be called the 'dimensionality thesis'. This is the thesis that the universe is a four-dimensional manifold of which one dimension is time. Backing this up is an analogy thesis according to which time is somehow strongly or weakly, analogous to space. Often the four dimensionalist will attempt to solve puzzles and construct arguments about time by appealing to the analogous spatial cases.[93] Some have challenged this analogy on a variety of grounds. It will suffice to outline one of these challenges here.

One critic of four dimensionalism is John Mackie.[94] Mackie acknowledges four dimensionalism's long heritage,[95] but ultimately rejects the four dimensional schema. For Mackie, four dimensionalism has no room to account for our everyday concepts of extrusion, flowing from, persistence, continuity, regularity, motion, change, growth, decay, development, and so on.[96]

Mackie's objection to four dimensionalism rests on the weakness of the alleged analogy between space and time. According to Mackie the analogy is not so strong that we could interchange the axes of space and time. He claims that the world would be very strange if the time dimension changed places with one of the spatial

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[92] See Ted Sider, 'Four Dimensionalism', *Philosophical Review* 106 (1997) pp.197-231 for a fuller description. Sider argues contra Merricks that four dimensionalism does not presuppose eternalism, or the view that all times are equally real.

[93] See Parsons, 'Must A Four Dimensionalist Believe...?'. n.2 for examples of these arguments from analogy.

[94] John L. Mackie, *The Cement of the Universe: A Study of Causation*, (Oxford: Clarendon, 1974).

[95] For example in Hume's *Enquiry* sect VII, pt II, pp.73-4 and also see Ayer's comment that "everything that happens in the world can be represented in terms of variations of scenery in a four-dimensional spatio-temporal continuum." A.J Ayer, *Probability and Evidence*, (London: Macmillan, 1972), pp.10-18.

dimensions. In such a scenario each persisting object or continuant would turn into a very long but very short-lived worm. Sudden changes we encounter as we move along some spatial straight line would become successive events in the same place. The direction of explanation (say from common cause to joint effects) would run from south to north (but not north to south), between simultaneous existents. Mackie argues that the fact that the very notions of space and time lose all intelligibility if we interchange axes means that any analogy between space and time is at best, very weak. Furthermore, Mackie claims that such transformations are disallowed by Special Relativity.[97] This is because:

No change in the co-ordinate system within the theory will turn what had been a line of simultaneity into a line of temporal succession in one place; no line representing the possible history of any persisting thing or causal process, however rapidly moving, can become in some other co-ordinate system the locus of a set of simultaneous events; possible light-paths constitute a rigid barrier between possible causal succession and what can, from any point of view, be seen as coexistence.[98]

Mackie is not merely making the point that time does not present itself in experience as if it were another dimension just like the spatial dimensions. His point is that if what is now experienced as temporal were experienced as spatial, and part of what is now experienced as spatial were experienced as temporal, the result would be ultimately unintelligible. As Mackie puts the point:

If we take the world just as Ayer's four-dimensional stage, it is remarkable that nearly all the long worms it contains are temporal ones, occupying possibly causal lines, and hardly any are spatial ones, occupying what could be lines of simultaneity - even telephone wires, railway lines, oil pipelines, and the like have considerable temporal persistence as well as spatial extension, and so come out not as worms but as thin two-dimensionally extended spatio-temporal sheets.

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[96] Mackie, *Cement of the Universe*, p.226.

[97] Ibid., p.227.

Now if there were nothing in the notion of what happens next flowing from what is there already, it would be a surprising coincidence that worms should be distributed through the four-dimensional scene in the selective way that they apparently are, whereas if there were something in the notion, the actual distribution is just what we should expect.[99]

This is but one example of the kinds of challenges mounted against the analogy thesis that forms an implicit part of four dimensionalism. By Mackie's lights, four dimensionalism falls down because the analogy between space and time cannot be sustained. I do not wish to mediate the case here; I merely mean to point out that four dimensionalism, although popular, is not held universally. Nonetheless many have been, and continue to be, convinced by the four dimensionalist schema. Take for example Quine's dictum that:

Physical objects, conceived thus four dimensionally in space and time, are not to be distinguished from events, or in the concrete sense of the term, processes. Each comprises simply the content, however heterogeneous, of some portion of space-time, however disconnected or gerrymandered.[100].

Quine in fact sums up the entire temporal part metaphysic in his *From A Logical Point of View.*

The truth is that you *can* bathe in same *river* twice, but not in the same river stage. You can bathe in two river stages which are stages of the same river, and that is what constitutes bathing in the same river twice. A river is a process through time, and the river stages are its momentary parts. Identification of the river bathed in once with the river bathed in again is just what determined our subject matter to be a river process as opposed to a river stage.[101]

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[99] Ibid., p.227-228.

[100] Quine, *Word and Object*, p.171. See also his 'Worlds Away', *Journal of Philosophy* 73 (1976) and 'Whither Physical Objects' in Cohen (ed.), *Essays in Memory of Imre Lakatos,* (Dordrecht: Reidel, 1976).

[101] Quine, *From a Logical Point of View: Nine Logico-Philosophical Essays*, (Cambridge: Harvard University Press, 1980).

Perdurantism is a package view. It contains various sub-theses, the most important of which are the dimensionality thesis and the thesis of temporal parts.

The world ... is a four-dimensional manifold of events. Time is one dimension of the four, like the spatial dimensions except that the prevailing laws of nature discriminate between time and the others – or rather, perhaps, between various timelike dimensions and various spacelike dimensions. (Time remains one-dimensional, since no two timelike dimensions are orthogonal.) Enduring things are timelike streaks: wholes composed of temporal parts, or stages, located at various times and places. Change is qualitative difference between different stages – different temporal parts – of some enduring thing, just as a "change" in scenery from east to west is a qualitative difference between the eastern and western spatial parts of the landscape.[102]

Reasons to be cheerful

Why might we think that perdurantism is true? In this section I want to develop the characterisation of this account of identity through time in order to point out some sophistications that render the account more appealing.

The argument from analogy revisited

As has already been pointed out some, such as Mackie, are not compelled by the analogy between space and time. However, others accept analogy and take it as a good reason to accept perdurantism.[103] Lewis expresses this analogy with:

Persistence through time is much like extension through space. A road has spatial parts in the subregions of the region of space it occupies; likewise, an object that exists in time has temporal parts in the various subregions of the total region it occupies.[104]

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[102] Lewis, 'The Paradoxes of Time Travel', pp.68-69.

[103] For examples of these arguments from analogy for perdurance see: Sider, 'Four Dimensionalism'; and Richard Taylor, 'Spatial and temporal analogies and the concept of identity,' in J.J.C Smart (ed.), *Problems of Space and Time*, (New York: Macmillan, 1964). Taylor, p.382, claims that "the concept of length or extension has a place in both [spatial and temporal] contexts, though it is easily overlooked. Things can be spatially long or short, but so too they can have a long or brief duration, i.e., be temporally long or short. ... The notion of length in turn leads to that of *parts*, both spatial and temporal."

The argument from analogy for perdurantism can be expressed in this manner:[105]

P1. Time is analogous to space, in particular, persistence is analogous to extension;

P2. All things extend by having different parts at different places;

Therefore all things persist through time by having different parts at different times.

This does seem intuitive on the face of it, but as has been noted not all are willing to accept the analogy thesis. Accordingly, and rather obviously, the intuitive pull of the argument from analogy is only as compelling as one initially finds the requisite analogy.

A modal argument

In his Postscript B to *Survival and Identity* Lewis offers a modal argument in support of perdurantism as follows.[106] It is possible that some person stage might exist. Further, it is possible for two non-overlapping successive person stages to exist, related in a way appropriate, so far as their intrinsic qualities go, for them to be adjacent stages of a person. There is a world in which perdurantism obtains, W_p, exactly like our own in its point-by-point distribution of intrinsic local qualities. This means that W_p is exactly like our own world in its causal relations between local matters of fact. In addition, every feature of W_p supervenes on its distribution of local qualities, and causal relations

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[104] Sider, 'Four Dimensionalism', p.197.

[105] This way of putting things is due to Parsons, 'Must A Four Dimensionalist Believe...?'. Although, note Parsons does not accept the analogy between spatial extension and temporal persistence. He prefers to see the argument as a *modus tollens* against premise 2, and concludes that not all things extend by having different parts at different places. Hence his argument that some things entend, or extend in space without having proper parts.

[106] Lewis, *Philosophical Papers Volume I*, p.76-77.

between local matters of fact.[107] Therefore, our world is a world of stages, or is a world in which perdurantism is obtains.

André Gallois argues against this modal argument for perdurantism on the grounds that it is not possible that some person stage exists.[108] To make the point, Gallois puts forward a parallel argument which runs like so:

(1') It is possible for an endurant person to exist;

(2') There is a world, W_e, of endurants which is exactly like ours in its point-by-point distribution of intrinsic local qualities and its causal relations between local matters of fact;

(3') Every feature of W_e supervenes on its distribution of local qualities, and causal relations between local matters of fact;

(4') Therefore our world is a world of endurants.

If Lewis is correct, then (4') that our world is a world of endurants, surely follows from the conjunction of (3') and (2'). Lewis might attempt to avoid this situation by rejecting either (2') – that there is a world, W_e, of endurants which is exactly like ours in its point-by-point distribution of intrinsic local qualities and its causal relations between local matters of fact, or (3') – that every feature of W_e supervenes on its distribution of local qualities, and causal relations between local matters of fact. Alternatively, Lewis could claim that four dimensionalism is only contingently true, and thereby reject (3'). However, as Gallois points out, if Lewis concedes (2') and rejects (3') he will undermine the plausibility of a premise of his own argument, namely that every feature of W_p supervenes on its distribution of local

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[107] Note that this premise is just the avowal of the doctrine of Humean supervenience. The endurantist might reply by denying this doctrine, but this is not discussed by Lewis. Note that Humean supervenience is discussed at (§3.1).

[108] Gallois, *Occasions of Identity*, p.267.

qualities, and causal relations between local matters of fact. Lewis must concede that

both W_e and W_p are possible worlds. They are both like our world in their distribution of

local intrinsic qualities and causal relations between local matters of fact. This then

means that W_p and W_e are exactly alike in their local intrinsic qualities and causal

relations between local matters of fact. However, W_e is a world of endurants and W_p is

not. Gallois concludes that Lewis's premise - that every feature of W_p supervenes on its

distribution of local qualities, and causal relations between local matters of fact, is false.

The only option for Lewis is to reject (2'). However, it is hard to see how he

can do this without first rejecting (1') - that it is possible for an endurant person to exist.

This is difficult indeed if Lewis wants to preserve contingency. All this leads Gallois to

conclude that Lewis modal argument in support of perdurantism turns out to be question

begging.[109]

Contemporary physics

Some maintain that perdurantism is the account of persistence that best fits our

contemporary physics. The idea here is that the analogy thesis (and by hypothesis, four

dimensionalism) is supported by the both the special and general theories of relativity.[110]

If either theory is true, so goes the argument, we *should* think of time as a dimension

additional to the three spatial dimensions. If we do this we will think of objects as being

extended in four dimensions, one of which is time.

Mellor is one critic of this argument for perdurantism. Mellor claims that

relativity theory should not be seen as transforming time into a space-like dimension.[111]

Mellor argues that even if time *is* a dimension analogous to the spatial dimensions, it

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[109] Ibid.

[110] Ibid., p.264.

[111] Mellor, *Real Time*, pp.66-72.

does not follow from this that material objects are extended in time the way they are extended in space. It would, he concludes, be consistent to say that relativity theory is true and yet an object's history is extended in time, rather than the object itself.

Contemporary logic

In his (1966) review of P.F Strawson's *Introduction to Logical Theory*, Quine comments that:

> The four dimensional view of space-time is part and parcel of the use of modern formal logic, and in particular the use of quantification theory, in application to temporal affairs.

What Quine means is that we sometimes take the existential quantifier to range over things that lack temporal characteristics – such as numbers. Therefore we should treat '($\exists x$)' as tenseless. Sometimes we want to say things like (i) At 12 p.m. the Prime Minister was drunk. However, this is not the same as (ii) ($\exists x$) (x = the Prime Minister & x is drunk). These are not equivalent, as (ii) makes no reference to times. However, (i) *is* the same as (iii) ($\exists x$) (x = the 12 p.m. stage of the Prime Minister & x is drunk). Quine concludes that the only way to preserve the tenselessness of the existential quantifier is to take it to range over the proper temporal parts of an object.[112]

I have briefly outlined some of the arguments that have been put forward in defence of perdurantism. But as should be clear, the position does have some challenges to face. Some of these challenges have been aimed at the temporal part metaphysic *per se*. Such objections do not focus on the details of the position, but strike at its foundation – the thesis that objects persist through time by way of having different temporal parts at different times. Many have mounted this sort of objection to

perdurantism.[113] Some of these objections form a cluster in that they all take as their starting point, the idea that the notion of parthood when speaking temporally leads to some kind of unpalatability. Those unpalatable consequences are referential indeterminacy, the failure of some fairly dearly held principles, and circularity. However, in my opinion these objections are easily overcome because they are really targeted at the way in which we *speak* about temporal parts – a fix is not difficult to find.

Referential (in)determinacy

Some object to perdurantism on the grounds that the position entails the possibility of a complete referential indeterminacy. We can simultaneously speak of, and make reference to, both a persisting object and some temporal parts of that same object. Perdurantism seems to entail that when we speak of any object there will inevitably be a certain amount of ambiguity as to what is being referred to. Are we talking about the extended object or the temporal part? Perdurantists maintain that as long as we are mindful of the difference, we can avoid referral error. What we must do is attribute genidentity between successions of temporal parts that is, we must specify what it is that makes two distinct temporal parts, parts of one and the same four dimensional object.[114] In later discussions I will discuss two such attempts to flesh out perdurantism in order

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[112] In his *Occasions of Identity*, p.265 Gallois offers a reply to Quine's argument that runs like so. (i) is actually equivalent to (iv) $(\exists x)$ (x = the Prime Minister & at 12 p.m.: x is drunk). This, it is said, does not mention temporal parts at all but still preserves the tenselessness Quine requires.

[113] Noted critics of perdurantism include: Broad, *An Examination of McTaggart's Philosophy*; Geach, 'Some Problems about Time'; Hacker, 'Events and Objects in Space and Time', *Mind* 92 (1982) pp.1-19; Haslanger, 'Endurance and Temporary Intrinsics'; Johnston 'Is There A Problem About Persistence?'; Mellor, *Real Time*; Simons, *Parts*; Thomson 'Parthood and Identity Across Time'; Van Inwagen, 'The Doctrine of Arbitrary Undetached Parts'; and Wiggins *Sameness and Substance*.

[114] Melin, *Persons*, p.56.

that it can specify what it is that makes two distinct temporal parts, parts of one and the same four-dimensional object. These are the continuity (§2.5) and causal (§3.3) versions of perdurantism. Roger Melin is one to defend perdurantism against charges of referential indeterminacy. He admits that we cannot perceive and have direct acquaintance of a persisting aggregate object because it exists at different times. What we do see is always a temporal part of an object. However, we can *refer* to a whole temporally extended object by referring to some of its temporal parts.[115]

This move notwithstanding, referential indeterminacy has been the basis of several other challenges to perdurantism. Related objections include the charge that perdurantism leads to unacceptable overpopulation. For example, on this position several distinct entities will exist at the same place at the same time whenever there exists an object-stage, which is an object-stage of a thing. In addition, there may be some confusion regarding counterfactuals. What are counterfactuals about? - The object or the object-stage? About whom am I thinking about when I think of myself in the future? These 'problems', I suspect are no more than the result of careless language. Think of the case of properties. I might be a proponent of trope theory, and yet I do not always say things like 'my what a lovely instance of blue', (although if pushed I would make myself clear). Similarly, the perdurantist might hardly ever say, 'the particular table-stage that I am observing now is brown', although they mean just that (as opposed to the table proper is brown throughout its entire history). These are not problems of referential indeterminacy, merely referential underdetermination.

Another related objection, based on problems of referring has to do with how we attribute properties to the parts of an object and to that object as a whole. André Gallois argues that perdurantists are committed to a thesis of equivalence (E), according

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[115] See Heller, 'Things Change', p.325-5 for a more detailed discussion of referential indeterminacy.

to which, necessarily ($\square$) at a time t, an object x has a property F then the t-part of that object x is F and vice versa, or

(E) $\square$ $(x)(t)$ (at t: $Fx \leftrightarrow$ the t-part of x is F).

Perdurantists want this equivalence because it provides a straightforward explanation of what it is for a perdurant to have a property at a time. For example, we can say that at 3 p.m. the brown book in front of me has a brown cover if and only if the 3 p.m. *part* of the book in front me has a brown cover. Secondly, the equivalence (E) is often an essential premise in arguments for four dimensionalism. Recall Quine's argument that the existential quantifier is tenseless, or Lewis' argument for four dimensionalism from temporary intrinsics. Both of these arguments depend on the further premise that any sentence of the form 'at t: Fx' expresses what is expressed by a sentence of the form 'the t-part of x is F'. It seems that the perdurantist needs the equivalence (E) to be true.[116]

But is (E) in fact true? Here are three counter examples to (E).[117] The first is asks us to consider the sentences 'McTaggart in 1910 was a philosopher holding Hegel's dialectic to be valid', and 'McTaggart in 1921 was a philosopher not holding Hegel's dialectic to be valid.'[118] Put simply, Geach denies that the 1910 *part* of McTaggart is a philosopher with beliefs, that is - he rejects (E) when he says:

To be sure, on the view I am criticizing the phrases 'McTaggart in 1910' and 'McTaggart in 1921' would not designate two philosophers, but two temporal slices of one philosopher. But that is just the trouble: for a predicate like 'philosopher believing so-and-so' can of course be true only of a philosopher, not of a temporal slice of a philosopher.

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[116] Gallois, *Occasions of Identity*, p.267-8.

[117] All of which are discussed at length in Gallois', *Occasions of Identity*, pp.267-9.

[118] A counter example due to Geach, 'Some Problems about Time'.

The absurdity does not come about just from my chosen example; it arises for Quine's example 'Tabby at *t* is eating mice'; for a cat can eat mice at time *t*, but a temporal slice of a cat, Tabby-at-*t*, cannot eat mice anyhow.[119]

Here is another counter example to (E).[120] The argument proceeds like so. Something, *x* with temporal parts cannot be held morally responsible because if *x* has temporal parts, and *x* is being held morally responsible for something done in the past, then the present temporal part of *x* is being held responsible for something performed by a distinct temporal part. But nothing is responsible for an act performed by something else. In other words, for Mellor, even if I am morally responsible for something done in the past, the present temporal part of me is not. Mellor concludes that (E) fails on this point and if (E) fails, then so does perdurantism.

Third, if a person, *A* remembers doing something that only *B* did earlier, then *A* is *B*. But no present segment of any person can remember doing something done by any previous segment of any person. That A remembers doing *x* is not equivalent to the present temporal part of *A* remembering doing *x*, therefore, (E) fails.[121]

There are several options available to the perdurantist at this point. She might consider rejecting the equivalence (E). However the perdurantist will still owe us an account of what it is for a perdurant to have a property that differs from the properties of its parts. She might say something like Tabby is eating a mouse at *t* just in case the *t*-part of Tabby contains the *t*-stage of some mouse part, and a suitable number of the *t*-parts of Tabby's successors each contain a progressively larger stage of the same mouse. Or she may say that Mellor is morally responsible for doing *x* just in case

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[119] Ibid.

[120] Due to Mellor, *Real Time*.

[121] This final counter example is due to Carter, 'Our Bodies Our Selves', *Australasian Journal of Philosophy*, 66 (1988) pp.308-319.

some perdurant that contains a past stage that did x is identical with Mellor. Or perhaps

Carter remembers doing x just in case the present stage of Carter contains a memory

impression which is *appropriately* causally linked to a past stage of Carter which did

x.[122]

This strategy is relevant to our purposes. The important phrase here is 'a

memory impression which is *appropriately* causally linked to a past stage of Carter'.

Such causal connections become the focus of what I will call causal perdurantism, and

rightly so it seems, if the perdurantists wants to maintain an equivalence such as (E).

Part-hood and circularity

Another challenge facing perdurantism is one that rests on the notion of parthood. Some

have argued that the thesis that objects persist by way of having temporal parts at

different times leads to circularity. Take, for example, the comment that:

[T]he temporal parts approach seems *blatantly* circular. For how are the 'temporal parts' of [objects] to be individuated and identified save by reference to the very [objects] of which they are parts?[123]

The idea here is that the very concept of a temporal part depends on a preconception of

a persisting whole object. This means that a temporal part of an object can only be

individuated by reference to its relative position *within the object of which it is a part*.

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[122] But really, each of these counter examples is mistaken. The mistake has arisen because the doctrine of temporal parts has not been fully articulated. Recall Lewis's stipulation that temporal part of persons can, (and do), do everything that persons do. Sentences like 'McTaggart in 1910 was a philosopher holding Hegel's dialectic to be valid', we refer to a temporal part of the whole person – McTaggart. As Lewis points out temporal parts are properly speaking *spatio* temporal parts. They live, walk breathe and have beliefs, just as temporally extended 'larger' persons do. A temporal part of McTaggart can hold a belief, just as Mellor at time *t* can be held morally responsible, and Carter at *t* can have all the memories he wants.

[123] Lowe, 'Lewis on Perdurance vs Endurance', p.68. For similar comments also see his 'What is a Criterion of Identity?', *Philosophical Quarterly* 39 (1989), pp.1-21, and Mellor's *Real Time*.

But this objection need not be a persuasive one. The perdurantist can simply say that she is *not* claiming that *if* the parts (of a persisting whole) are connected *then* they are the parts of a persisting whole, but rather that *if* certain 'bits' are found to be connected appropriately, only *then* will they warrant the label 'part'. This should show that any apparent circularity in this sense is specious, or at least benign, as it results from a simple error in emphasis, or order of argumentation

In this section, I have outlined some reasons why we might want to accept perdurantism. If it is true that perdurantism rests on an analogy between spatial and temporal parts, then the position will only be as strong as the equivalence we consider to hold between the spatial and temporal dimensions. In addition, perdurantism does not lead to referential indeterminacy or circularity (in the sense mentioned above). It turns out that any apparent referential indeterminacy is the result of careless language and is rectified if we pay attention to our part-whole discourse. In addition, there is no circularity in the notion of temporal parts, if we are careful in the way in which we deem parts to be parts of one persisting object.

2.2 A perdurantist solution to the problem of temporary intrinsics

In the previous chapter, I outlined two objections to endurantism, namely the problem of temporary intrinsics and the problem of changes in parts. Can the perdurantist provide satisfactory solutions to these problems? In a word – yes. The perdurantist has a ready response to both of these puzzles.

Recall that the problem of temporary intrinsics is as follows. According to endurantism an object persists by way of being wholly present at every moment at which it exists. An object at one time is numerically identical with itself existing at a later time. However, that object may change in certain ways, in particular with regard to

its temporary intrinsic properties. However by Leibniz's Law, if two objects are identical (or are in fact one object), they must share all and only each other's properties. As this is not the case, the 'two' objects are not identical, and therefore there has been no persistence through time.

The perdurantist account of identity through time is in part an attempt to overcome the above-mentioned objection to endurantism. How can one object O be F at t_1, and yet lack F at t_2? The perdurantist answer is of course that O is *not* wholly present at both t_1 and t_2. It is not the case that one single object O, possesses contradictory properties, rather it is the case that two *temporal parts* of the mereological sum O have different properties, and this is clearly not contradictory. This is surely a boon for the perdurantist's case, however as we shall see the position is not free from its own challenges.

2.3 A perdurantist solution to the Russell-minus objection

Recall the problem of changes in parts for endurantism. The problem was that given the transitivity of numerical identity, the three propositions (1) Russell-before-t is numerically identical with Russell-after-t, (2) Russell-minus-after-t is numerically identical with Russell-minus-before-t, and (3) Russell-after-t is numerically identical with Russell-minus-after-t, taken together entail the truth of a fourth proposition (4) Russell-before-t is numerically identical with Russell-minus-before-t. Recall also that this led to the endurantist being committed to the contradictory statement that (5) Russell-before-t is not numerically identical with Russell-minus-before-t.

What can the perdurantist make of this apparent contradiction? In short, the perdurantist claims to be in a position to characterise the problem in such a way that contradiction is avoided. For example, it could be said that Russell's survival through

the loss of his left little finger does not presuppose the truth of either (1) or (2). That is, Russell himself does survive although it is not the case that either (1) Russell-before-*t* is numerically identical with Russell-after-*t*, or (2) Russell-minus-after-*t* is numerically identical with Russell-minus-before-*t*. Instead, the perdurantist is free to claim that in fact Russell is an aggregate of temporal parts, and his persistence through time is simply a matter of his having different temporal parts which exist at different times. Both 'Russell-before-*t*' and 'Russell-after-*t*' are to be seen as temporal parts of the aggregate 'Russell-proper'. For this reason Russell-before-*t* and Russell-after-*t* are not numerically identical. Rather, the two objects stand in the weaker relation of being parts of a single, continuous spacetime worm. In the same way, Russell-minus should be treated as an aggregate of temporal parts. So, even if it is the case that Russell-minus-before-*t* and Russell-minus-after-*t* do not differ in their parts, they remain numerically distinct temporal parts of the aggregate that is Russell-minus. Russell and Russell-minus are both aggregates that are related in a way that has something to do with the truth of (3) Russell-after-*t* is numerically identical with Russell-minus-after-*t*.

Russell and Russell-minus are overlapping aggregates, that is to say that although they are distinct, they share a part. Their temporal parts before *t* are numerically distinct, however there is a single thing that is their temporal part after *t*. Here, we are simply referring to the thing that we first called 'Russell-after-*t*', and then called 'Russell-minus-after-*t*'. They are two separate spacetime worms, which merge after *t*, at which point they occupy the same region of spacetime. So, we can see that the perdurantist is able to reject both (1) and (2) in order to avoid the kind of contradiction which we saw confront the endurantist.[124]

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[124] It should be noted however that in the above argument the endurantist was only committed to the truth of (4), in virtue of the fact that they had been attributed with the endorsement of each of (1) - (3).

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2.4 Objection (1) The inadequacy of spatiotemporal and qualitative continuity

I said earlier that there are two main variants of perdurantism – one is based on spatiotemporal continuity alone, and another, which incorporates causal connectedness between temporal parts. The task is to explain the identity conditions for physical objects in terms of some relation – often called *gen-identity* – that stages bear to each other just in case they are stages of the same persisting object. The first variant of perdurantism takes spatiotemporal continuity to be that relation. In the following discussion this version of perdurantism we will see that although the spatiotemporal continuity account (or SQC) is the basis of the causal variant, it is deficient in various ways. In fact, the deficiencies of SQC as an account of the identity through time of physical objects are a motivating factor in the formulation of causal perdurantism.

Cashing out continuity

The first variant of perdurantism is based on ideas of continuity. As Chris Swoyer points out:

According to the most popular view about the trans-temporal identity of physical objects, a necessary condition for the gen-identity of objects stages is that they be spatiotemporally continuous: contiguous or connected by an intervening series of stages that are contiguous.[125]

What we look for here are certain types of continuity between temporal parts, in order to ascertain whether or not they are temporal parts of the same object, that is – to

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Admittedly, a strawman has materialised. For, it appears that no endurantist (that I know of) will in fact accept as true all of (1) - (3).

[125] Chris Swoyer, 'Causation and Identity', in *Midwest Studies in Philosophy*, vol 9 (1984) p.596.

establish identity through time. SQC takes, as its starting point, the maxim of perdurantism that objects are successions of events, or temporal parts/object-stages. What links these different stages together such that they form the history of a single object is the fact that they belong to a spatiotemporally continuous series of thing-stages. This account can be formalised in this way.[126] A succession S of object-stages corresponds to stages in the career of a single persisting object if and only if:

(1) S is spatiotemporally continuous; and

(2) S is qualitatively continuous.

So according to SQC, persistence is seen in this way. Suppose that an object, say an apple, is green at time t_1 and red at a later time t_2. According to SQC, this is true if and only if; first we can trace a succession S of apple-stages such that S contains a green-apple-stage at t_1 and a red-apple-stage at t_2, and if second, S is spatiotemporally and qualitatively continuous. This then means that particulars are equivalent to certain space-time paths, or world lines. So if an object is persisting through time what binds together the successive stages of the career of that single persisting object is the fact that the contiguous stages of that single career are qualitatively very similar and spatiotemporally very close. This however must not be thought of as precluding any change in the object. Over a period of time an object may alter in its qualities and spatiotemporal location, but it must do so continuously, and only by small degrees. We can say that,

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[126] This formalisation is due to Eli Hirsch in his *The Concept of Identity*, (New York: Oxford University Press, 1982), p.8. He calls it the 'Simple Continuity Analysis' to distinguish it from more sophisticated versions.

.. if x exhibits spatiotemporal continuity at a time t, then there is an interval around t such that, for any t_i in that interval, the place x occupies at t overlaps, to some degree which may be short of total overlap, the place x occupies at t_i.[127]

This concept of overlap means that the tree that suddenly loses a branch or the painting which has a blob of paint added to it will retain spatiotemporal continuity in the face of relatively radical change. In summary, the mainstay of this account is that two conditions - qualitative and spatiotemporal continuity are jointly necessary and sufficient for a succession of object-stages to correspond to the stages in the career of a persisting object.

We can distinguish between two types of continuity. A succession S is *weakly* continuous just in case the change that S undergoes can be divided into a series of small qualitative changes. A succession S is *strongly* continuous just in case the change it undergoes can be divided into a series of changes as small as you like. But strong spatiotemporal continuity is not necessary for a succession to constitute a single persisting material object. For, we can refine our concept of weak spatiotemporal continuity such that;

Weak SQC: A succession of object stages S is weakly continuous just in case, for any time t (during which some member of the succession exists), there is an interval ι about t such that for any t_2 in ι, the place occupied by the member of S at t_2 overlaps the place occupied by the member of S at t by more than half, i.e. the extent of overlap is greater than the extent of non-overlap.[128]

It is not difficult to see why we find SQC so appealing. If we cannot see how an object could get from one region of space-time to another by a continuous path

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[127] Oderberg, *The Metaphysics of Identity Over Time*, p.21.

[128] Following Hirsch we can call this 'moderate spatiotemporal continuity'.

then it does not seem to matter how similar the object at one region is to the other, for we simply do not think we should count them as one. In addition, it seems that SQC is required if we want to guarantee a fact of the matter about the trans-temporal identity of objects.[129] For example, if we do away with the conditions of SQC we will be forced to say that an object O could jump two feet to the left without traversing the distance in between, and this seems highly counter-intuitive. Imagine another case, in which the object O disappears and objects P and Q, which are qualitatively indiscernible from O immediately appear, P two feet to the left of where O had been and Q two feet to the right of that point. Each object could equally be counted as identical with the O. However, by the transitivity of identity this cannot be the case. Therefore, neither is identical with O.

What of objects that do not always have definite spatiotemporal locations? According to our best microphysics, elementary particles do not have a definite position at all times, but rather have a superposition of many (until we collapse the wave packet by performing a measurement). This is surely a difficulty for SQC. The spatiotemporal continuity of fundamental particles is far from straightforward. Space does not permit a full treatment of this issue here. It is little wonder that the spatiotemporal indeterminacy of fundamental particles which at some point leads to determinate locations for middle-sized objects, is controversial (to say the least). This is to say nothing of the fact that our familiar, medium sized objects contain much empty space, have indefinite borders and can survive abrupt changes in volume.

Such facts make it difficult to explain a sense in which the stages of material objects enjoy spatiotemporal continuity in a way that does not include too little or too much to capture intuitions about identity.[130]

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[129] Swoyer, 'Causation and Identity', p.597.

[130] Ibid., p.599.

Not surprisingly then, there is considerable controversy as to exactly what continuity amounts to.[131] For the sake of brevity I will assume that in this context continuity amounts to something like this. An object, or space-time worm is actually a series of filled place-times, that is, it is a series of ordered pairs (p, t) where p_1 is a filled region of space and t_1 is a filled moment of time. To say that the filled space-time path P of an object is 'spatiotemporally continuous', is just to say that where $(p_1.t_1)$ and $p_2.t_2)$ are filled place-times in P, then t_1 is very close to t_2 and p_1 is very close to p_2. Similarly, to say that P is 'qualitatively continuous' is just to say that where $(p_1.t_1)$ and $(p_2.t_2)$ are filled place-times in P, then if t_1 is very close to t_2, the object which occupies p_1 at t_1 exemplifies qualities at t_1 which are very similar to the qualities exemplified at t_2 by the object which occupies p_2 at t_2.

Continuity as a sufficient condition

But is SQC really a necessary and sufficient condition of persistence? Some have said not. In fact it turns out that SQC is neither necessary nor sufficient for identity. We can employ thought experiments involving immaculate deceptions to see why this is the case.[132] Armstrong shows us why SQC is not sufficient for identity. He describes a case in which spatiotemporal continuity is present but there is no case of identity:

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[131] See Robert C. Coburn's 'Identity and Spatiotemporal Continuity', in Milton K. Munitz (ed.), *Identity and Individuation*, (New York: New York University Press, 1971), pp. 54-6 for an extended discussion of the concept of continuity with partricular reference to the problems of vagueness and incompleteness in contemporary definitions of continuity.

[132] These kinds of thought experiments have been proposed (independently) by: David Armstrong, 'Identity Through Time'; and Sydney Shoemaker 'Causality and Properties', in Peter Van Inwagen (ed.), *Time and Cause: Essays Presented to Richard Taylor*, (Dordrecht: Reidel, 1980).

Suppose then, that there are two very powerful deities, each able to annihilate and create, who operate quite independently of each other. The first deity decides to annihilate Richard Taylor and does so at place p, time t. The second deity has not been watching what has been happening. He decides to create a man at p and t. By a coincidence which can only be described as cosmic, he decides to give this man exactly the same physical and mental characteristics that Taylor had at p and t. Life goes on as usual. The question is 'Did Taylor survive?' 'Is $Taylor_2$ identical with $Taylor_1$?' I hope the reader will agree with my intuition that he did not and is not. It is true, of course, that everybody earthly, including $Taylor_2$, will take for granted (because they will not even raise the question) that $Taylor_2$ is $Taylor_1$. But I think that only shows that, given the right stage setting, it is logically possible that we should be deceived about anything at all, including Taylor about Taylor's identity.[133]

Swoyer echoes Armstrong's concerns, when he says:

Clearly, though, mere spatiotemporal continuity of stages is not sufficient for their gen-identity. When the steamroller ran over Aunt Gussie's candelabrum, (the stages of) her candlestick and this shard of metal left behind enjoyed spatiotemporal continuity. But the shard and the candelabrum are not identical.[134]

Swoyer attempts to discern whether or not we are employing the correct kind of continuity in these cases. Perhaps a different type of continuity will lead to a sufficient condition for identity. If we could isolate the appropriate type of continuity that gives genidentity for object stages, this will give identity through time of physical objects. One considered option is to add the requirement of structural or compositional continuity.[135] However as Swoyer explains, such continuity is difficult to explain precisely and in fact is not sufficiently discriminating to succeed in this purpose, for:

A deflated balloon retains its identity through rapid change whereas the candelabrum would not have been identical with shard even if it was transformed into it by a long, slow series of tiny changes.[136]

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[133] Armstrong, 'Identity Through Time', p.76.

[134] Swoyer, 'Causation and Identity', p.596.

[135] This solution is advocated by both: C.D Broad, 'Leibniz's Predicate-in-Notion Principle and Some of Its Alleged Consequences', *Theoria* 15 (1949) p.393; and W.V.O Quine, *Theories and Things*, (Cambridge: Harvard University Press, 1981). p.125.

[136] Swoyer, 'Causation and Identity', p.596.

A more promising approach, (one which might ensure the sufficiency of SQC), is that

of sortals. On this sort of response we require spatiotemporal continuity 'under a

(substance) sortal', at least while the object in question remains the same sort of thing.[137]

Can sortals preserve sufficiency?

The claim is that it is our failure to pay attention to sortals that has led to the failure of

SQC. We can give a sortal analysis of persistence such that, a succession of object

stages S constitutes a single, persisting material object just in case:

(i) S is spatiotemporally continuous;

(ii) S is qualitatively continuous;

(iii) For some sortal term F, each stage of S is an F-stage; and

(iv) S is not a proper part of any succession of F-stages that satisfies (1) – (3).

This third condition to rules out deviant successions in which stages fall under different

sortals. A sortal is a term F such that any succession of F-stages that satisfies (1) – (4)

constitutes a single persisting F-thing. Hirsch stipulates that terms such as 'apple' and

'truck' are sortals, however terms which usually apply to overlapping things or

'dispersive terms', such as 'mass of wood', or 'brown thing' are not. This is because if

we were to trace objects under such terms we would find that we are tracing deviant

successions. All of this leads Hirsch to formulate his 'basic rule' which he says leads to

our concept of persistence. The basic rule is as folows:

(i) S is spatiotemporally continuous;

(ii) S is qualitatively continuous;

(iii) S minimises change at every time t occupied by some member of the sequence; and

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[137] Hirsch *The Concept of Identity*, chapter 2.

(iv) *S* is not part of any longer sequence that satisfies (1) – (3).

But do we really know what sortals there are? In addition, we might doubt that an object of a certain sort must *always* be an object of that sort. Swoyer provides his own counter example.[138] When a parent amoeba splits into two, or two drops of water merge into one, there is spatiotemporal continuity under a sortal and there is qualitative and compositional continuity – but there is no identity. We could say that cases of fission and fusion just do not preserve continuity. However, this is too strong. We could say that spatiotemporal continuity is sufficient for genidentity only if it is a one-to-one relation. That is, a stage existing at one time is genidentical with a stage existing at a later time only if each is spatiotemporally continuous with *only* one stage existing at the other time.

Ultimately, we should be convinced by counter examples, such as that given by Armstrong. Here is yet another counter example to SQC, which also involves replacement.

Imagine that a group of fanatical environmentalists invent an extraordinary machine that can instantaneously destroy pickup trucks and that Detroit counters with a machine that can instantaneously create pickups out of nothing. Using methods like Mill's, we find that the first machine has unfailingly wiped out trucks, leaving nothing in their wake, while in independent tests the second machine has created trucks where none had been before, and the properties of the created trucks depended entirely on the settings of the machine. In short, we have just the sort of evidence that normally supports causal attributions and generalizations (we might also imagine that we have a well-confirmed physical theory that predicts and explains all of this).

One day the truck annihilator destroys the pickup out there in the driveway, and quite coincidentally the operator of the truck creator sets its controls and creates a qualitatively indiscernible pickup that picks up exactly where the first truck had been.

We have an immaculate replacement, or so it seems. If we do, we have a case of spatiotemporal continuity under a sortal, plus qualitative, structural and chemical continuity. Yet we have distinct trucks. Hence all of these conditions put together are not enough to ensure the trans-temporal identity of physical objects. True, we don't have compositional continuity here, for if the trucks are two, they are presumably

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[138] See Swoyer, 'Causation and Identity', fn..3, pp.619-620.

composed of different matter, but any attempt to save the continuity theory by pleading the lack of compositional continuity faces the problems of its own.[139]

We should be convinced that such examples show that spatiotemporal continuity under a sortal (plus all the other sorts of continuity) is not sufficient for the identity of physical objects through time.

David Lewis employs a similar style of argumentation to show that, in his opinion, SQC is not sufficient for identity. He describes this case, in which a replacement is intended to show that SQC is not sufficient for the personal identity through time of a time-traveller.

Fred was created out of thin air, as if in the midst of life; he lived a while, then died. He was created by a demon, and the demon had chosen at random what Fred was to be like at the moment of his creation. Much later someone else, Sam, came to resemble Fred as he was when first created. At the very moment when the resemblance became perfect, the demon destroyed Sam. Fred and Sam together are very much like a single person: a time traveller whose personal time starts Sam's birth, goes on to Sam's destruction and Fred's creation, and goes on from there to Fred's death. Taken in this order, the stages of Fred-*cum*-Sam have the proper causal connectedness and continuity. But they lack causal continuity, so Fred-*cum*-Sam is not one person and not a time traveller. Perhaps it was pure coincidence that Fred at his creation and Sam at his destruction were exactly alike; then the connectedness and continuity of Fred-cum-Sam across the crucial point are accidental. Perhaps instead the demon remembered what Fred was like, guided Sam toward perfect resemblance, watched his progress, and destroyed him at the right moment. Then the connectedness and continuity of Fred-cum-Sam has a causal explanation, but *of the wrong sort*. Either way, Fred's first stages do not depend causally for their properties on Sam's last stages. So the case of Fred and Sam is rightly disqualified as a case of personal identity and as a case of time travel.[140]

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[139] Ibid., pp.597-598.

[140] Lewis 'The Paradoxes of Time Travel', p.173 (emphasis added). It is interesting that Lewis notes here that the causal connection in this case is 'of the wrong sort'. In a later section (§3.4) I will discuss the role that appropriateness plays in perdurantist accounts.

Continuity as a necessary condition

Some objectors to SQC point out that these conditions are not jointly necessary for persistence. Such objectors draw the conclusion that SQC is, at best, incomplete. By way of an example, Russell acknowledges that continuity is partially implicated in identity through time. Accordingly, he writes:

Given any event A it happens very frequently that, at any neighboring time, there is at some neighboring place an event very similar to A. A 'thing' is a series of such events. ... It is to be observed that in a series of events which common sense would regard as belonging to one 'thing', the similarity need only be between events not widely separated in space-time. There is not very much similarity between a three month embryo and an adult human being, but they are connected by gradual transitions from next to next and are therefore accepted as stages in the development of one 'thing'.[141]

However, Russell also recognised that SQC is not a stand-alone position. Similarly, Armstrong provides a case where there is no spatiotemporal continuity, but there is identity through time.

If Taylor$_1$ appears to be annihilated at t_1 and p_1, and Taylor$_2$ comes into existence at t_2 and p_2 as, or much as, Tayor$_1$ was at t_1 and p_1, and if further the coming-to-be of Taylor$_2$ stands in a suitable causal relation to Taylor$_1$, then Taylor$_2$ would appear to be simply a later phase of the existence of Taylor$_1$. ... Spatiotemporal continuity of phases of things appears to be the mere result of, an observable sign of, the existence of a certain sort of causal relation between the phases.[142]

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[141] Bertrand Russell, *Human Knowledge,* (New York: Simon and Schuster, 1948), p.488.

[142] Armstrong, 'Identity Through Time', p.76. Swoyer gives a similar example, "Suppose that our two machines can also instantaneously relocate trucks a few feet from their original position (as judged from the inertial frame of the truck). One day the first machine relocates my neighbour's pickup in my driveway, the second machine creates a new truck in his driveway exactly where his old one had been, and then the first machine relocates it in my driveway just as the second machine transfers the first truck back to its original position. We have an immaculate interpolation in which a single truck exhibits spatiotemporal discontinuities, and so spatiotemporal continuity is not necessary for identity." 'Causation and Identity', p.598.

The idea that SQC is not necessary for identity has relevance in modern physics. Physicists speculate that the matter – although not the same object – absorbed by a black hole passes through a worm hole into a distant region of space-time. In addition, physicists tell seemingly coherent stories about spatiotemporal gaps in the histories of objects.

Thus the ordinary conception of identity does not seem to require spatiotemporal continuity. This ordinary conception may be inconsistent, contain tensions, or need to be revised for some other reason, but since this is not obviously so, some argument is needed to show that it is. Meanwhile, such examples rob the continuity theory of much of its commonsense support.[143]

The force of immaculate replacement examples

How convincing are these kinds of counter examples? There are a few reasons that we might think such cases are less than convincing.[144] Firstly, these cases of replacement seem to violate conservation laws. In addition, in most of the examples the relevant interpolations have instantaneous relocations and so are not easily reconciled with the relativity of simultaneity. What counts as spatiotemporally continuous judged from one frame of reference will not seem so when judged from a second frame that is discontinuous with respect to the first. Thirdly, the continuity theorist might ask why these interpolations are taken to be relocations rather than simple destruction and creation. One suspects that the intimation here is that taking the interpolations involved in these cases to be relocations begs the question as to whether identity is even involved in the examples.

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[143] Swoyer, 'Causation and Identity', p.599.

[144] Ibid.F, p.598.

Nevertheless, the examples can be refined such that these problems do not arise. For example, we can build an example involving objects that are created from matter in a given location rather than from nothing. Alternatively, we might give a more detailed theoretical background to the examples. In the end, it does not matter whether or not the machines involved are metaphysically possible. What is relevant is that the examples show, at least that it is not an *a priori* truth that they are not metaphysically possible. This means that it is not a conceptual truth that spatiotemporal continuity (of the appropriate sort) is either necessary or sufficient for the identity through time of objects.

2.5 Summary

In this chapter, I have introduced the position known as perdurantism. We saw that perdurantism provides satisfactory responses to both the problem of temporary intrinsics and the problem of changes in parts. However, as has been seen, the first variant of perdurantism, SQC, turns out to be neither necessary nor sufficient for identity through time. This is shown by various immaculate replacement counter-examples to continuity, in which an object displays spatiotemporal/qualitative continuity, but not identity.

The following chapter presents a second problem for perdurantist accounts of identity based on spatiotemporal and qualitative continuity. This is the rotating disc argument. This second objection has led some to supplement SQC with causal connectedness. An outline of causal perdurantism is given in chapter three. This is followed in chapter four by an analysis of the causal perdurantist response to rotating disc arguments. There, I will argue that supplementing spatiotemporalism with causation cannot do the work required. The burden of the next two chapters then, is to

show that supplementing continuity with causation, in order to avoid rotating disc arguments, only leads the perdurantist into more problems. Most importantly, it means that perdurantism becomes circular.

Chapter 3: A second objection to perdurantism: rotating disc arguments

This chapter introduces a second objection to the perdurantist account of identity based on continuity (or SQC). The problem comes when the perdurantist attempts to describe the states of motion of homogenous objects in terms of spatiotemporal and qualitative continuity. In (§3.1) the objection is outlined and the point is made that the objection has its basis in the fact that the objection from motion stands as a challenge to the doctrine of Humean supervenience. This section also examines two responses to the objection from motion. The first response challenges the status of states of motion of homogeneous objects. The second questions the distinction between motion and stasis in rotating disc arguments. In the following section, (§3.2) a third response is discussed. It is an attempt to supplement spatiotemporal continuity with other factors in order to resolve the problem of motion. As it turns out, none of these fixes are satisfactory. In the following section, (§3.3), the second variant of perdurantism (causal perdurantism) is introduced in an attempt to avoid this objection. Causal perdurantism builds on continuity-based perdurantism but adds causal relations as a 'fix' for the problem of motion. This second variant of perdurantism, it is said, succeeds in refuting the objection from homogeneous material in motion where SQC has failed. In (§3.4) causal perdurantism is discussed in more depth. In particular, this section examines the *nature* of the causal relation said to constitute the identity through time of objects. It should become clear in this section that whatever the nature of these causal relations, they must be free from identity claims. This chapter closes with an examination of why the account of identity through time, based on causal relations between temporal parts must

be wary of circularity. This final discussion will pave the way for the challenge of chapter four – Can we provide a non-circular account of the causal relation that is said to lie at the heart of identity through time?

3.1 Rotating disc arguments

This section outlines the objection from homogeneous objects in motion to continuity-based accounts of identity (SQC). The objection takes the form of various examples involving homogenous objects and finds that accounts of identity based on spatiotemporal and qualitative identity fail to characterise the states of motion of such objects. In the previous chapter (§2.5) the point was made that 'immaculate replacement' counter-examples[145] show that continuity is not sufficient for the identity through time of material objects.[146] Now we turn to a second objection to SQC as an account of identity.

The objection from homogenous objects in motion takes various forms in the literature. However although the form differs the content is the same and as a result I will refer to these objections under the blanket term 'Rotating Disc Arguments', or RDA.[147] Rotating disc arguments are based on the close connection between our

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[145] Proposed (independently) by: Armstrong, 'Identity Through Time'; Swoyer, 'Causation and Identity' and Shoemaker, *Identity, Cause and Mind.*

[146] As was mentioned in the previous chapter, it so happens that David Armstrong doesn't think spatiotemporal continuity is necessary either. He says, "Mere spatial and temporal continuity, together with resemblance of temporal parts, can be shown to be insufficient. Indeed neither sort of continuity seems even to be necessary. ... What seems necessary in addition is the actual *bringing into existence* of later by earlier temporal parts." *A World of States of Affairs*, (Cambridge: Cambridge University Press, 1997), p.74.

[147] In this I follow Craig Callender in his 'Humean Supervenience and Rotating Homogeneous Matter', *Mind* 110 (2001) pp.25-44. The objection comes in many forms, some using two discs - one of which is

concepts of persistence and motion. The problem arises when an SQC account of identity is put to the task of explaining the identity through time of any kind of homogeneous 'stuff'. Examples of such stuff have included: homogeneous incompressible fluid[148], infinitely extended, uniformly homogeneous rivers[149] and solid spheres or discs made of completely homogeneous material containing no empty space.[150] An early formulation, due to C.D Broad, comes as a response to the attempted reduction of enduring things to persistent form.[151]

As was pointed out towards the close of the previous chapter (§2.5), Russell had reservations about the success of continuity-based accounts of identity. These worries have, at their base, the identity conditions for homogeneous fluid.[152] The rotating disc arguments form a collection, and although they are sometimes put to different purposes, they invariably centre around the motion of homogenous objects.

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rotating, the other of which is stationary. Others use homogeneous spheres, and still others use two rotating discs each of which spins in different directions. Here, I will treat these as equivalent.

[148] See C.D Broad's *The Mind and Its Place in Nature*, (London: Routledge & Kegan Paul, 1925), p.34.

[149] Saul Kripke, Unpublished lectures given at Cornell, on *'Time and Identity'* (1978).

[150] See Kripke, Unpublished lectures and Armstrong, 'Identity Through Time', p.76.

[151] Broad, *The Mind and Its Place in Nature*, pp.36-37. Broad argues that the reduction of the persistence of stuff to the persistence of form will not go through in the case of homogeneous fluid. The reduction will only succeed he argues in the case of 'solid bodies with sharp outlines'. For further discussion of Broad's arguments see Dean Zimmerman's 'Temporal Parts and Supervenient Causation, the Incompatibility of Two Humean Doctrines', *Australasian Journal of Philosophy* 76 (1998) pp.265-66. Zimmerman argues that the reduction of the persistence of stuff to the persistence of form is very close to the reduction of a persisting object to a sum of non-persisting or instantaneous temporal parts.

[152] In his 'The Relation of Sense-data to Physics', in his *Mysticism and Logic* (New York: Doubleday, 1957 [1917]) p.165, Russell writes, "... continuity is not a sufficient condition of material identity. It is true that in many cases, such as rocks, mountains, tables, chairs etc., where the appearances change slowly, continuity is sufficient, but in other cases, such as the parts of an approximately homogeneous fluid, it fails utterly. We can travel by sensibly continuous gradations from any one drop of the sea at any one time to any other drop at any other time."

Here, we are interested in one use of RDA – its challenge to continuity-based accounts of identity through time.

Here is one version of the rotating disc argument against SQC.[153] This version involves an infinitely long river made of a uniform homogenous fluid. The river flows at some rate and in some direction. Kripke sees the motion of such rivers as a threat to perdurantism, or the thesis of temporal parts, and to illustrate this asks us to imagine a volume of the liquid that contains no currents. Imagine another volume of the liquid that does contain currents. According to perdurantism, both volumes are made up of temporal parts with precisely the same material properties that stand in precisely the same spatiotemporal relations. This is the force of homogeneity. On a perdurantist account of the volumes' persistence, the difference between the two cases is lost. The charge is that the temporal part metaphysic cannot distinguish between a series of momentary river-stages that constitutes a river flowing one way, from one that flows the other.

Although Kripke sees this version of RDA a threat to perdurantism *per se*, it is not difficult to recast the argument as a challenge to continuity-based perdurantism. Recall SQC is the view according to which, a succession S of object-stages corresponds to stages in the career of a single persisting object if and only if: (1) S is spatiotemporally continuous; and (2) S is qualitatively continuous.

According to an SQC analysis of identity the truth values of all cross-temporal identity propositions that hold in a world should follow from a description of

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[153] This version of RDA is due to Kripke. His argument is discussed by Shoemaker in his *Identity, Cause and Mind*, and in Harold Noonan's 'Substance, Identity and Time', *Proceedings of the Aristotelian Society supplement* 62 (1988) pp.79-100.

the history of that world as a series of what we can call 'holographic states'.[154] A

holographic state is a three dimensional moving picture, each 'frame' of which is a

hologram. Each holographic state is a maximal description of the way the world was at

a particular temporal instant. Among the properties that an object has at a time are states

of motion, such as moving relative to some other thing at a certain velocity, accelerating

at a certain rate, rotating with a certain angular velocity, and so on. However, the

description of the world as captured by the holographic state must *not* be such that it

implies the existence at any *other* moment in time of any of the things referred to, or

quantified over, in it. This means that holographic states can describe the properties of

the world in question but they *cannot* include states of motion. Why are states of motion

excluded from the holographic state? - Because, states of motion imply facts about

identity through time.[155]

Recall Kripke's river example. The question of the river's (non)motion

cannot be resolved by reference to states of motion of momentary river-stages because

any characterisation of these states of motion will certain require trans-temporal identity

facts. This will lead to circularity.[156] The charge is that SQC cannot account for a

variety of facts about motion. For example it cannot distinguish a situation in which a

sphere of a completely solid, homogeneous material is rotating, from one in which such

an object is at rest. The problem is that according to SQC, we must view both situations

as involving a series of instantaneous, spatiotemporally continuous sphere-stages.

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[154] A term due to Kripke. I take my description of Kripke's argument from Shoemaker *Identity, Cause and Mind*, p.242.

[155] Ibid.

[156] Ibid., p.243. Shoemaker goes on to sum up Kripke's worries about states of motion for homogeneous material like so: "[I]f the world described includes a perfectly uniform disc made of homogeneous material, the description of the holographic states will be the same whether the disk is stationary of rotating, and will be the same no matter at what rate it is rotating."

However, the notion of the holographic state shows us that, because the stages are instantaneous, they are incapable of motion. Furthermore, since the simple relation of spatio-temporal continuity is present in the same way stage for stage in each case, no difference between the two situations can be described using just the resources available to the continuity theorist.

Whilst Kripke puts forward a version of RDA as a case against perdurantism itself, David Armstrong uses RDA as a reason for preferring the causal version of perdurantism over one that is based on spatiotemporal and qualitative continuity alone.[157] The argument begins with the assertion that in general we *can* tell the difference between a spherical object rotating on its own axis and the same object stationary. However, this is *not* the case with spherical homogeneous objects. In these cases, we *cannot* tell the difference between rotation and stasis.[158] As this is contrary to our intuitions, continuity based accounts of identity are false. Here RDA is functioning as a motivation for the causal account of identity. The argument is that, as SQC cannot differentiate between two states of affairs that are *ex hypothesi* distinct, an account that can make this difference (causal perdurantism) is to be preferred.[159]

Compare a rotating sphere with one that is stationary. The two spheres will appear the same in all regards, or so the argument goes. However, surely there must be a fact of the matter. Each of the spheres is either rotating, or it is not rotating and there must be something that makes this true. Imagine one portion of the sphere, *P*. We know

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[157] Armstrong, 'Identity Through Time', p.76-7.

[158] However, it is important to note that the point of RDA is not merely epistemological. True, we cannot tell the difference between rotation and stasis, but this is made true by the fact that there is, in fact, no thing that could make this difference.

[159] The adequacy of Armstrong's claim that causal relations can make this difference is scrutinised in chapter four (§4.1).

that portion P now occupies the SE position or quadrant of the sphere. We need to know if this portion P, which is in the SE quadrant at t_2, is the same portion as portion P, which was in the NW quadrant at t_1. If the two portions are identical, the sphere has rotated - if not, the sphere is stationary. Now, according to SQC, P at t_1 and P at t_2 are identical just in case they are spatiotemporally and qualitatively continuous. The problem then, seems to stems from the homogeneity of the sphere. All sphere portions are spatiotemporally and qualitatively continuous; therefore, on this view they are *all* numerically identical. But this is absurd. We simply cannot allow an extended object such as the sphere, all of whose parts are identical. SQC alone cannot determine facts of identity for homogeneous objects in motion.

So far, we have seen the threat RDA poses a threat to the broad thesis of perdurantism and to SQC more specifically. I want to investigate what it is that lies beneath the success of RDA in continuity contexts. I will follow a convention, according to which rotating disc arguments are characterised in terms of impact on the doctrine of Humean supervenience.

This impact takes the form of a dilemma. If the Humean attempts to locate the difference between a rotating and a stationary homogenous sphere, she must relinquish either the thesis of temporal parts (perdurantism), or the doctrine of Humean supervenience.[160] According to the doctrine of Humean supervenience, everything

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[160] This dilemma is spelt out more fully by David Lewis in his 'Zimmerman and the Spinning Sphere', *Australasian Journal of Philosophy* 77 (1999) p.209. For more on the doctrine itself see his *Philosophical Papers Volume II*, p.xiii and 'Chance and Credence: Humean Supervenience Debugged', *Mind* 103 (1994) p.475; and Michael Tooley's, 'Laws and Causal Relation', in *Midwest Studies in Philosophy volume 9* (1984), pp.93-112.

supervenes on the spatiotemporal distribution of local intrinsic properties.[161] In other words, everything supervenes on the 'Humean basis', where this basis is understood to be the intrinsic, locally instantiated qualities and external spatiotemporal relations between space-time points. For the Humean there is 'no difference anywhere without a difference in the arrangement of qualities'.[162]

So what exactly is threat to Humean supervenience and how does that threat relate to the challenge to SQC? The reasoning is as follows - if RDA is correct, Humean must either abandon Humean supervenience, or reformulate the doctrine such that it includes a larger subvenient base set of properties – something that the average Humean will not relish. To elaborate, RDA shows that neither the Humean basis nor the properties that supervene upon it can distinguish a rotating from a stationary (homogeneous) disc or sphere. Since *ex hypothesi*, there is a difference, Humean supervenience fails to account for a significant difference between them.[163] This argument should sound familiar - it parallels an earlier argument against SQC. This is because continuity-based accounts of identity *just are* Humean accounts. SQC takes identity to be a matter of spatiotemporal and qualitative continuity among *distributions*

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[161] Following Armstrong, (*A World of States of Affairs*, p.11-12) I define supervenience like so. An entity Q supervenes on an entity P if and only if it is impossible that P should exist and Q not exist, where P is possible.

[162] Callender, 'Humean Supervenience and Rotating Homogeneous Matter', p.25. Callender points out that any Humean worth her salt owes us an explanation here. For example, she must make some attempt to clarify what is meant by the terms 'natural' and 'intrinsic' in relation to properties. She must also decide; whether or not 'instantiation at a point' precludes vectorial qualities, such as velocities, which lie on tangent planes to surfaces, how Humean supervenience might be modified to deal with quantum non-locality, and of course give us some reason to want to be Humean in the first place. Callender does point out that more sophisticated definitions of Humean supervenience can be found. See for example, that of Barry Loewer outlined in his 'Humean Supervenience and Laws of Nature', *Philosophical Topics* 24 (1996) pp.101-127.

[163] Callender, 'Humean Supervenience and Rotating Homogeneous Matter', p.27.

of local intrinsic properties. Continuity accounts call on the continuity of the Humean

basis to establish identity facts and this is why RDA's challenge to continuity-based

accounts of identity amounts to a dilemma for the friend of Humean supervenience. To

elaborate, let us return to a specific example of a rotating disc argument:

> Suppose for instance we are comparing two worlds, in all other respects just alike in their distribution of
> qualities, one of which contains a stationary disc of homogeneous matter, while the other contains an
> exactly similar disc which rotates... Then it seems that the arrangement of qualities in the two worlds will
> be identical.[164]

The disc contains perfectly smooth, homogeneous material and is therefore composed

of non-atomistic 'stuff'.[165] Because it is not composed of atoms, we cannot trace out the

four-dimensional world lines of this stuff in order to discover whether the disc is

rotating, (that is, whether its world line traces out a helical corkscrew-shape or not).

Furthermore, because the discs are homogeneous, one spatial part at one time is as

similar to another spatial part at another time as to any other spatial part at that time.

Therefore, the Humean cannot use her usual set of resources (relations of similarity and

continuity) to identify spatial and temporal parts across time. This means that the disc's

(non)rotation does not supervene on the Humean basis. Therefore, Humean

supervenience fails, as does any account of identity based on spatiotemporal and

qualitative continuity.[166]

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[164] Dennis Robinson 'Matter, Motion and Humean Supervenience', *Australasian Journal of Philosophy* 67
(1989) p.402.

[165] Callender, 'Humean Supervenience and Rotating Homogeneous Matter', p.27.

[166] One possible defence here is that as Humean supervenience is a contingent thesis and since
homogeneous spheres do not populate our world, (rotating or otherwise), the objection is irrelevant. But
can we be so sure? As Callender reminds us, homogeneous objects are simply atomless objects of
uniform composition. We in fact do *not* have any good grounds for claiming that such objects do not exist
in worlds such as our own. Furthermore, it is by no means certain that the actual world does not contain

This section has seen the introduction of rotating disc arguments as an objection to SQC, or accounts of identity through time that are based purely on spatiotemporal and qualitative continuity. This objection stands as a challenge to SQC due to that account's connection with the doctrine of Humean supervenience.

3.2 Defending perdurantism against rotating disc arguments (badly)

In this section, I will examine several defences of a spatiotemporally based account of identity against RDA.[167] My hope is that this discussion will further emphasise the impact of RDA and its consequences. The first of these comes from the idea that rotation and in fact, any motion whatsoever, *does not make sense* in the scenarios described. The second is similar in intent but concludes that there simply is *no difference* between rotation and stasis in scenarios involving homogeneous objects. As it turns out, neither of these defences will go through. The section proceeds with a discussion of a group of defences that attempt to supplement continuity with some other factor in order to avoid RDA. These factors are; instantaneous velocities, centripetal forces, relativistic effects and vectorial properties. This section examines each of these factors in order to show that none of these additions is satisfactory.

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such objects. Contemporary science can be taken as suggesting that the fundamental atoms of our world are homogeneous and spatially extended. So the Humean cannot take refuge in contingency at this point.

[167] Clearly, endurantism gives a ready solution to RDA. In his 'Identity Through Time', p.77, Armstrong emphasises this point when he says, "It is here that the identity view becomes attractive, as enabling us to draw the distinction. Suppose that the sphere is not rotating. Consider, then, the eastern portion of the sphere from t_1 to t_2. The phases of the eastern portion will not merely remain identical in nature (as they would if the sphere were rotating), but will at all times be phases of the very same thing, in the sense which an identity analysis would yield. If, however, the sphere starts to rotate, then such an identity of the eastern portion will not be maintained except at the instants when the sphere has made exactly N revolutions, for any whole number N."

Is homogeneous motion genuine?

Here is one possible defence of spatiotemporal accounts of identity against RDA.[168] The idea here is that RDA is not compelling because the kind of homogeneous objects required by RDA are *not* the sorts of things that belong in our ontology. Interestingly the problem with RDA is seen as lying not with the discs' homogeneity, but with their motion. The proponent of RDA must claim that there *is no way to tell the difference* between the two discs. This is a crucial part of the framing of the case. However, if a photon or piece of dust lands on the disc the fact of rotation is then revealed. Therefore, RDA will only go through in extreme cases, namely, ones in which the discs are completely isolated or lonely. However, this has the consequence that the disc worlds are, in fact, very far away from our own. If the sphere is completely isolated, the world that it inhabits is nothing like ours and is not compatible with the laws of physics as we know them. It seems the only way for RDA to get off the ground is to postulate worlds very far from our own. What RDA requires in fact, is a disc that is not coupled with any fields that exist in our world. However, 'then such a disc is no different from a ghost, and is not something Humeans or non-Humeans ought to posit.'[169]

In addition, we can ask - Why should we call this rotation if we cannot tell the difference? If the physical laws are even remotely similar to those of the actual world, we should expect to perceive distinguishing physical effects such as; a rotating disc should stretch perpendicular to its axis of rotation, the surface of homogeneous stuff should become concave when rotating, not to mention the fact that rotating homogeneous spheres should be ellipsoid shaped. Yet, none of these effects of actual-world rotation are apparent in RDA. We cannot blame the absence of rotational

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[168] Discussed by Callender, 'Humean Supervenience and Rotating Homogeneous Matter', p.36.

[169] Ibid., p.37.

phenomena on the discs' homogeneity, for if the discs have mass they should behave in a regular this-worldly fashion. The discs should display rotational effects for:

If the laws are anything like ours, homogeneous matter sculpted into a top should display its rotation by precessing. Do homogenous discs rotating at different speeds have different kinetic energies, or different thermal properties? And in general relativity, the gravitational field can tell the difference between a single elementary individual rotating and one non-rotating …, for the spin couples to the curvature of spacetime producing deviations from geodesic motion. Rotating objects will 'drag' their inertial frames around with them – and this will be manifest in properties of the spacetime.[170]

Here we have an objection to the very starting point of RDA, that is the idea that a homogeneous object is in motion and yet displays no rotational phenomena. The objection comprises two claims. First comes the claim that rotation without rotational phenomena just isn't rotation. The second claim is that if, for example, one disc is rotating while the other is not, to assert that there is 'no difference' between the two is to posit a distinction without a difference, a 'cardinal sin according to any scientific methodology'.[171]

For RDA to have any impact on continuity-based accounts of identity the two possible worlds must be in all respects alike in their distribution of local qualities (except in the fact of (non) rotation). Otherwise, there simply is no threat to SQC and the Humean can locate the difference between rotation and stasis in characteristic events associated with rotating discs. However, if the environments of the discs must be effectively the same - *how is rotation understood in this argument?* According to this

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[170] Ibid., p.37-8. For more discussion of rotational effects see Misner, Thorne and Wheeler, *Gravitation,* (San Francisco: W.H Freeman & Co., 1973), pp.1117-1121.

[171] Callender 'Humean Supervenience and Rotating Homogeneous Matter', p.38. Callender is frustrated by the lack of tangible detail accompanying RDA and complains that, as if it were not enough that the examples fail to specify physics of homogenous matter and the worlds that contain them, the cases also neglect to relate RDA to the this-worldly but similar problem of explaining rigid body circular rotation.

objection rotation, as understood in RDA, is not rotation at all and the challenge to SQC is dissolved.

The 'no difference' defence

As was said above, RDA works from the assumption that there is a genuine difference between the two homogeneous spheres. One response to RDA is to deny that there is a genuine difference between rotation and stasis in the context of homogeneous objects.[172] To explain: Imagine a case in which a sphere is unaccompanied in its world by any other object. Can continuity-based accounts of identity and the associated thesis of Humean supervenience distinguish between the two cases in an otherwise empty universe? Will there really be a difference between a rotating sphere, alone in its universe and a similar stationary sphere, equally lonely? The proponent of RDA wants there to be a genuine difference, but what will this difference be grounded in? Can we bite the bullet and respond with the claim that there really is *no difference* between the two spheres? Call this the 'no difference' defence of spatiotemporal continuity. The no difference defence can be framed in parallel with arguments in favour of absolute space (and time).

Kant argued against the relational view of space. The relationalists' counterargument is somewhat akin to the no difference defence against RDA. Kant argues that 'handedness', or chirality implies that space is absolute. One reply is to say that there simply is no difference between the two possible worlds described. This reply comes from an externalist perspective such that a hand's being left or right depends on how it is related to other asymmetrical (or enantiomorphic) objects. On externalism,

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[172] Ibid., p.31-34.

Kant's two worlds have all the same relations. Therefore they are, at best, two descriptions of the same world. Without another asymmetric object for reference, handedness is nonsensical. In fact, in such empty worlds there is no fact of the matter about handedness. 'Handedness' will only make sense if there are hands of opposite orientation around. Similarly, 'up' and 'down' only make sense when different directions are defined with respect to a fixed reference point, such as the gravitational gradient of the earth.

The parallel is not difficult to draw. We can simply claim that there is no difference between the two possible worlds of RDA. They are at best two descriptions of the one possible world. Similarly, rotation will only make sense if the physical effects characteristic of rotation are present, such as the surface tension on discs typical of rotation, angular momentum about their centre of mass, the distortion typical of rotation, the trajectories typical of spinning objects, and so on. Therefore, *if* we splash paint on the disc then the disc is rotating if the paint spins around with respect to some frame of reference. *If* we touch the disc and there is some effect typical of rotation, then it is rotating. There is no difference between rotation and stasis in RDA because the homogeneous objects involved are isolated. Without external objects with which to move in relation to there can be no motion because in empty worlds, there is no fact of the matter about motion.

Despite the no difference defence, commentators generally agree that there is a real difference between rotation and stasis in RDA. The fashion is to see RDA as a genuine threat to perdurantism or more specifically SQC, and therefore to Humean supervenience. RDA needs there to be a difference between the two cases - one that is not captured by factors involved in spatiotemporal continuity.

Consideration of two intuition pumps makes it clear that we *do* tend to think there should be a difference.[173] Firstly, imagine a rotating sphere covered in orange polka dots. This sphere is clearly not homogeneous. Imagine further that as the sphere spins, one by one the polka dots begin to fall off. Eventually no dots remain and the sphere is completely homogeneous. Now, we were sure that the sphere was in motion when it was spotty, surely the fact of motion does not become indeterminate just because the sphere is now spotless! Second, imagine two machines, each of which continually produces discs. Objects placed on the discs produced by one machine always spin. In this case, it seems fair to say that the weight of inductive evidence should convince us that the disc in question is actually in motion.

Considering such intuitions, we should conclude that we have good reasons for thinking that there is a genuine difference between rotation and stasis in homogeneous objects and that there must be something that makes this true. If this is correct, and homogeneous rotation is genuine, then RDA remains a threat to SQC.[174] But the question remains – if homogeneous motion is genuine, what makes this true? I

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[173] Callender discusses two such intuition pumps 'Humean Supervenience and Rotating Homogeneous Matter, (p.27-8). Armstrong gives us another in his 'Identity Through Time', p.77.

[174] In her 'Persistence and Non-supervenient Relations', *Mind* 108 (1999) p.55-56 Katherine Hawley dismisses the no difference defence for another reason. She says "If there is no fact of the matter about whether a given disc is rotating, then there is no fact of the matter about what would have happened if someone had touched the disc, or had splashed paint onto it. ....Any event, which makes the disc slightly inhomogeneous – the landing of a speck of dust on the disc, for example – would give the disc a determinate rate of rotation for all time. .... this produces a bizarre classical analogue of the quantum measurement problem." Hawley is clearly equating RDA and the no difference defence with something like the indeterminacy posited by quantum mechanics that arises out of the so called 'measurement problem'. She is unhappy about the consequences. This defence (what Lewis calls 'biting the bullet'), is flawed according to Hawley because it will mean that we cannot give determinate answers to the counterfactuals involved in RDA. This consequence is too much for Hawley, who abandons the no difference defence.

will now turn to an examination of just what that factor that marks out rotation from stasis might be.

Supplementing continuity (velocities, forces, relativistic effects and vectors)

Responses which are motivated by the requirement to save Humean supervenience, (and with it, spatiotemporal continuity), from RDA typically attempt to supplement the Humean basis with some factor which will differentiate between rotation and stasis. As Zimmerman puts out the challenge: .

> One might put it by asking the following question concerning two series of seemingly intrinsically indiscernible instantaneous sphere-stages, one belonging to a rotating sphere and the other not: Upon what properties of the two series of sphere-stages could the difference between their states of motion supervene? What difference in the stages themselves, or in their relations to one another or other things, could account for or ground this difference?[175]

I will investigate four candidates for making this difference here, before turning to detailed discussion of causal perdurantism (§3.3).

Defence from instantaneous velocities

Perhaps we might try to supplement the Humean basis with instantaneous velocities?[176] Such a strategy investigates the possibility of utilising instantaneous angular velocities of portions of the disc/sphere to distinguish between rotation and stasis. If two homogeneous objects are compared, one of which is in motion and one of which is not, and assuming that both are composed of a series of instantaneous sphere stages, we can ask - how will they differ? We could perhaps attribute different instantaneous velocities

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[175]Zimmerman, 'Temporal Parts and Supervenient Causation ...', p.269.

or accelerations to different parts of the instantaneous sphere stages. That an object has

a certain velocity at a certain instant amounts to the fact that derivatives of a function

specifying its location at different times yield certain values.

But instantaneous velocities cannot supply a fix for RDA for two reasons.

First, it is clear that:

> ... something that existed only for (or at) a durationless instant could not move, and could not have
> instantaneous velocity.[177]

This amounts to a denial of the possibility of any meaningful concept of 'velocity',

marked out at an instant. Here we are reminded of Kripke's holographic states and their

inability to capture states of motion due to their brevity. The point made is equivalent -

velocity implies movement, and movement takes time to occur. Second, because states

of motion imply facts of identity, they cannot figure in the intrinsic properties of a

genuinely instantaneous entity. Any attempt to differentiate the portions in terms of

instantaneous velocity will rely on the specification of their locations at different times.

This leads to circularity in that the persistence of the portions in question has been

presumed. This circularity stems from the fact that states of motion can only be

characterised in terms of persistence.[178] So much for instantaneous velocities. What this

tells us is that SQC, as an account of identity (and in fact any account which relies on

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[176] A strategy explored and rejected by Zimmerman in his 'Temporal Parts and Supervenient Causation
...'.

[177] Shoemaker, *Identity, Cause and Mind*, p.243.

[178] As Shoemaker notes, "If the causally relevant properties include states of motion, then it seems that the
attempt to analyse cross-temporal identity in terms of causality will be circular." Ibid., p.256.

the existence of object-stages) cannot adequately characterise states of motion (in particular, states of motion of homogeneous objects), and is therefore false.[179]

Defence from centripetal forces

Can forces mark the difference for us?[180] Can we claim that the momentary states of a rotating disc or sphere will be different from those of a stationary one with respect to the forces that exist at each moment of time? This attempted solution plays on the idea that instantaneous forces would operate on the parts of the rotating sphere but not on the parts of the stationary one.

The problems with this strategy are twofold. First the concept of force is closely tied to the concept of acceleration, and is therefore tied to the concepts of motion and velocity. If we allow instantaneous forces to operate on temporal parts we will, in effect, be positing instantaneous velocities and all of the problems that attend them. Second, even if we *could* posit such forces we still could not differentiate between the spheres. To see why this is the case, compare two spheres rotating in opposite directions, at the same speed.[181] In each case the curvilinear motion of the parts

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[179] Furthermore, in his 'Temporal Parts and Supervenient Causation ...', Zimmerman argues that the Humean basis can only be supplemented in this way if we turn to instantaneous velocities that are not understood in the way that Russell sees them (that is, velocity in the sense of a real number which is the limit of a certain set of quotients). According to Zimmerman instantaneous velocities can only do the required work if conceived of as intrinsic, in the manner of Michael Tooley. See Tooley's, 'In Defense of the Existence of States of Motion', *Philosophical Topics* 16 (1988) pp.225-254. However, as Zimmerman points out, intrinsic velocities are *non*-Humean and so, Humean supervenience fails. Whether there exist states of motion defined at temporal instants, and whether such states are non-Humean, is a controversial question, the discussion of which, space does not permit.

[180] Shoemaker discusses the role of forces in the two-sphere case in his *Identity, Cause and Mind*, fn.13, p.243.

[181] Is there any difference between a case in which two spheres are posited, (one in motion and one stationary) and another in which two spheres rotate in different directions? Callender maintains that there is not, although Zimmerman disagrees.

is the result of forces exerted on parts further from the centre of rotation by parts closer

to the centre of rotation. However, in the two-sphere case the centripetal forces are

exactly the same, even though the spheres are moving in different directions.[182] So it

seems that attempts to supplement the Humean basis with forces will not save

spatiotemporal continuity accounts of identity from RDA.

Defence from relativistic effects

There is another defence of to consider.[183] This defence works from the idea that we

need a solution based on non-supervenient, non-spatiotemporal external relations, not

unlike the non-supervenient relations allegedly found in quantum mechanics.[184]

According to the strategy, in order to distinguish rotation from stasis we must posit a

kind of temporal non-locality. Friends of this approach maintain that the rotation in

RDA is intrinsic, and yet also allow that the rotation can be conceived of *relationally* as

being between the sphere's spatial parts and other physical objects or space-time

points.[185] This is an attempt to locate the required difference in relativistic effects. We

might want to say that there will be a certain amount of contraction of the moving

sphere, and even more contraction the faster it moves.

The defence from relativistic effects is unsatisfactory for these reasons.

First, if this solution is to go through, it must take for granted the trans-temporal identity

of the spatial parts needed. If these identity facts are not assumed, any relational

understanding of rotation will fail. This is because in RDA contexts the relata in

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[182] Zimmerman ,'Temporal Parts and Supervenient Causation ...', pp.268-9.

[183] This is the preferred strategy of Katherine Hawley . See her 'Persistence and Non-supervenient
Relations'.

[184] For a good discussion of Hawley's defence, see Callender's 'Humean Supervenience and Rotating
Homogeneous Matter', pp.29-31.

[185] Hawley ,'Persistence and Non-supervenient Relations', fn.3, p.54.

question will all be the same (just as the spheres' environments are the same). Therefore, we cannot understand the sphere's motion in a traditional relationalist way without falling into the kind of circularity mentioned above.[186]

However, there is second reason to avoid relativistic effects. Compare two spheres rotating in different directions. Any effects of rotation, say contraction, will be the same in this case. In addition, it may be the case that such length contraction of objects is contingent and there could be worlds in which spinning objects do *not* display the effects of rotation we find in this world.[187] It might be that not all possible rotating objects display rotational effects. The idea that although a massive body is rotating it might display none of the features we ordinarily associate with this type of motion is certainly counter-intuitive. For:

The rotation with which we are familiar always has physical effects, eg. inertial effects, even if imperceptibly minute. How do proponents of RDA conceive of the disc's rotation? If we take a plate and place it on a putatively rotating homogeneous disc, what happens?[188]

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[186] This counterargument is elaborated upon by Callender in his 'Humean Supervenience and Rotating Homogeneous Matter', fn.6, p.30.

[187] A possibility explored by Dean Zimmerman in his 'One Really Big Liquid Sphere: Reply to Lewis', *Australasian Journal of Philosophy* 77 (1999) pp.213-215.

[188] Callender, 'Humean Supervenience and Rotating Homogeneous Matter', p.36. To press Callender's point – must massive bodies display rotational effects if they are to count as being in motion? Callender discusses three positions that answer in the affirmative – that is, that rotational phenomena *are* essential to rotation *being* rotation. First, the externalist will claim that rotation is essentially bound up with the motions of other bodies, in the way that directions, such as 'up' and 'down' are bound up with the direction of the local gravitational gradient. Second, some will claim that the properties of the homogeneous objects are individuated by their causal role. Since the two discs appear to occupy the same causal role in the two worlds, they simply do not have different properties. They either are both moving or are both still. Third, we might reply that since we operate with the 'best system package deal' we can say that the two worlds share the same best system, and positing a distinction that makes no difference goes against our best scientific methodology. Therefore, what we really should say to the proponent of RDA is that either both discs are rotating or neither is. Callender equates this last response with the reply from Kripkean semantics to the idea that water can be not H_2O.

But we do like to think that rotational phenomena are contingent.[189] Moreover if they are

contingent then their presence or absence cannot be taken to mark out non-rotation from

rotation. The proponent of RDA requires that there be *no* observable effects of rotation

– recall the phrase – 'there is no way of telling'.[190] Surely this is a strange state of

affairs. We might want to say that although rotational effects are contingent, all such

bodies will display rotational phenomena 'if given the chance'.[191] That is, if some

external factor enters the scenario, say, a splash of paint or a mite of dust on a disc, this

will allow us to 'tell the difference'. Homogeneous bodies in motion will display

rotational phenomena, if given the chance. Hawley maintains that a plate *will* spin on its

axis of symmetry if the disc it is placed on is rotating. This is because the physical laws

of the rotating disc-worlds are similar to those of our own. However, as Callender has

pointed out, this means that in RDA scenarios, the homogeneous objects involved must

be extremely isolated – and *not* interfered with by one mite of dust, or even one

photon.[192] The homogeneous object must be completely lonely, such that nothing

whatever touches it that could allow us to 'tell the difference'. Otherwise, rotational

phenomena will be displayed and the force of RDA will be lost.

Third, it is not at all clear that homogeneous objects would display any

rotational effects whatsoever. Those homogeneous objects in motion, because

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[189] In her 'Persistence and Non-supervenient Relations', p.61, Hawley has this to say to the defender of the
necessity of rotational phenomena attending rotating objects: "I might respond, as Kripke might, that
there is nothing inconceivable about a stationary cup of coffee with a concave surface, nor, indeed, about
rotating coffee with a flat surface. The difference between concavity and flatness happens to be correlated
with the difference between rotation and rest, but this is a contingent matter, and should not be taken as
constitutive of the difference between rotation and rest."

[190] Armstrong, 'Identity Through Time', p.77.

[191] Hawley, 'Persistence and Non-supervenient Relations', p.56.

frictionless, will simply *not* display such phenomena.[193] Therefore, a plate placed on a

rotating disc will remain stationary because the disc is perfectly smooth and therefore

frictionless. On this view, rotating homogeneous discs do not display rotational

phenomena even if 'given the chance' because they are frictionless.

The upshot of this discussion is that rotational phenomena, however

conceived will not serve to 'tell the difference'. If it is the case that homogeneous

objects in motion, *do* display rotational phenomena 'if given a chance' – then these

effects are a contingent matter, and therefore cannot be used to solve RDA. If, on the

other hand, RDA scenarios present *no* rotational effects because of their absence of

friction, then these non-effects likewise cannot be used to solve RDA. Either way, the

case for rotational effects seems grim.

However the question of the contingency of rotational effects deserves

further attention. Recall the idea here is that even if the bodies in question *do* display

this-worldly rotational effects, we are not warranted in taking this as evidence of

rotation. A rotating homogeneous cup of coffee, for example, might retain a flat

surface.[194] But surely there must be *some* physical effect present for us to have a reason

to count an object as rotating. It seems that the rotating coffee with a flat surface can

only be made sense of if *some* kind of rotational effect is perceived – in this case -

flatness. But any effect that the proponent of RDA sees, the Humean sees also. If the

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[192] Callender, 'Humean Supervenience and Rotating Homogeneous Matter', p.38.

[193] A view defended by Zimmerman in his 'Temporal Parts and Supervenient Causation ...'.

[194] The coffee example is due to Hawley. Callender provides evidence for why we should not expect all of the physical characteristics of rotation to be present in RDA. He cites David Malament's 'A No-Go Theorem about Rotation in General Relativity' (to appear in David Malament (ed.), a *Festschrift* for Howard Stein, forthcoming, (Open Court Press). Malament claims that some of the natural features of rotation are not present in all models of general relativity. He concludes that as some of the effects of

Humean can find one distinguishing effect in the rotating object, the case for RDA is lost, for then we can after all tell the difference.

Defence from vector-like qualities

In his recent discussion of RDA's impact on Humean supervenience, Lewis attempts to supplement spatiotemporal continuity in order to avoid RDA.[195] The task is to find some difference in the spatiotemporal arrangement of local qualities that will make the difference between rotation and stasis. He proposes to add vector fields to the Humean basis in order to solve RDA. The idea is that we need second-order quasi-qualities that have the character of vectors in order to solve RDA.[196] These vector fields are said to be local in nature and pervade the spheres.[197] The difference between the spheres is, at bottom, a difference in the spatiotemporal direction that these vectors point. So:

The difference between the spinning sphere and the stationary sphere is a difference in the shape of the worldlines of persisting point-sized bits of matter. If the sphere is spinning, they are helical: some persisting matter is first on the east side, then the west side, then the east side again... If the sphere is stationary, they are straight, parallel to one another in a timelike direction.[198]

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rotation do not hold in even in nomologically possible worlds, we can have a concept of rotation rich enough such that it is not tied to any one physical effect.

[195] Lewis, 'Zimmerman and the Spinning Sphere', p.209. Lewis presents three alternatives, the first of which is a version of the no difference defence. The second alternative is to concede that perdurantism is shown false by RDA and abandon it in favour of endurantism. The third is to abandon the doctrine of Humean supervenience.

[196] Ibid. Lewis also thinks this will benefit in our understanding of electromagnetism. In this Lewis takes his lead from Denis Robinson in his 'Matter, Motion and Humean Supervenience'. For discussions of Robinson's defense, see Shoemaker's *Identity, Cause and Mind* and Tooley's 'In Defense of States of Motion'.

[197] How do we know these vector fields count as local? Lewis says that a vector quality associated with a space-time point (or a point sized bit of matter) will be local. His reason for thinking this is the fact that classical electromagnetism will fail Humean supervenience if vectors are taken to be non-local.

[198] Lewis, 'Zimmerman and the Spinning Sphere', p.209.

As a perdurantist Lewis claims that objects persist through time by way of relations between their spatial and temporal parts. Importantly Lewis is, in fact, a *causal* perdurantist. He thinks the most important relation in this regard, (or 'glue' as he calls it), is that of causation. This leads Lewis to equate the worldlines of bits of matter with lines of causal dependence. According to the above quoted passage, this means that if the sphere is spinning the causal lines will be helical, whereas if it is stationary they will be straight.

On this view, causal lines, which are governed by vector fields, determine motion.[199] Therefore the vector gives the direction of the causal lines through any spacetime point within the sphere at that point. In other words, the spin of the sphere is necessarily determined by the causal lines, which are lawfully determined by the vector fields. According to the defense from vector-like qualities this satisfactorily resolves RDA.

There are several problems with this defense. First, there may be more than one vector field pervading the sphere. We need to identify the *correct* vector field - and the correct vector field will be the one that occupies the right *nomological* role. However, any attempt to state a law that can characterise the correct vector field will be circular.[200] For example, circularity will arise if we formulate a law according to which the correct vector is that property of an object such that;

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[199] Ibid., p.210.

[200] Zimmerman, One Really Big Liquid Sphere, p.282. Lewis is aware of the problem and comments "It presupposes that we are already given the lines of persistence through time. But our plan was to define persistence in terms of causal lines governed by the vector field that obeys the very law that we are now attempting to state." 'Zimmerman and the Spinning Sphere', p.210.

V1: Its possession by an object at each instant of the interval, together with [the object's] location at the beginning of the interval and the length of the interval, determines where *that very same object* will be at the end of the interval.

It seems that no matter how we try to reformulate the law such that it yields the correct vector, circularity will follow us.[201] What is required is a law that characterises the vector field that governs the causal lines, which defines the lines of persistence that determines whether or not the sphere is rotating. By Lewis' lights, Robinson has led the way to the formulation of such a law. What we must do is,

... see the collection of qualities characteristic of the occupation of space by matter as in some sense jointly self-propagating; the fact of matter occupying space is itself causally responsible, *modulo* whatever destructive forces there may be in the matter's environment, or whatever self-destructive tendencies it may have, for the matter going on occupying space in the near neighborhood immediately thereafter. Such a process must be directed . . .

[The posited vectors] figure causally in determining the direction of propagation of [themselves as well as] other material properties.[202]

Following Robinson's lead, Lewis puts forward a law of propagation of matter such that

L1: If there is matter at a spacetime point, and if the vector associated with that matter points in a certain direction, then at the next moment matter will appear at the place toward which that vector was pointing.[203]

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[201] As Lewis notes if instead of saying 'the very same object' we instead say 'that very same causally connected chain of point-sized matter-stages' our law will remain circular because it will presuppose that we already have the relevant causal lines, which are not made transparent to us under Humean supervenience, (all that we are given is the spatiotemporal arrangement of local qualities). Similarly, we cannot take refuge in the idea of 'that very same chain of matter-stages connected by lines of perfect qualitative similarity'. Although this option is not circular, it will fail in non-particulate homogeneous matter, as chains connected by lines of qualitative similarity run everywhere.

[202] Robinson, 'Matter, Motion and Humean Supervenience', pp.406-7.

A Robinson-style law of propagation is said to answer Zimmerman's challenge. Lewis claims that his law of propagation avoids circularity in that it does not presuppose that we are already given *either* the relevant lines of persistence or the causal lines.[204] However, the defence from vectorial qualities faces a similar, but somehow inverse problem to that faced by relativistic effects. The defence from relativistic effects led us to problems regarding worlds in which a homogeneous object is completely isolated. Vectorial qualities, on the other hand, fall into difficulty in worlds that contain *nothing but* homogeneous material. Lewis has found a law that is not viciously circular in the perdurantist's mouth, or dependent on non-supervenient causal relations. However, the law fails prey to this objection - it fails to recognise differences in motion among homogeneous stuffs in worlds that are, as a matter of physical necessity, *full* of such stuff.[205] The objection is that our intuition that homogeneous stuff is possible is not compatible with the possibility of worlds in which Cartesian physics obtains. Such worlds contain no absolute bits of matter and no vacuums. Can we use Lewis's law to pick out the right vector field in such worlds? Lewis's law is intended to characterise those vector fields that determine the direction of self-propagation. Recall, the law states,

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[203] Lewis, 'Zimmerman and the Spinning Sphere', p.211. Lewis puts the following provisos on this law: (1) the law must be defeasible; (2) the law is not restricted in the manner that Robinson's version is, namely, identifying the propagation of matter with the propagation of some distinctive bundle of qualities; (3) the law must not presuppose that there *is* a next moment. Lewis also wants to allow for worlds in which time is discrete, or continuous. The law for a world in which continuous time obtains is as follows: Let *p* be any spacetime point, and let *t* be any smooth timelike trajectory through spacetime with *p* as its final limit point. Let each point of *t* before *p* be occupied by matter with its vector pointing in the direction of *t* at that point. Then, *ceteris paribus*, there will be matter also at *p*.

[204] Lewis, 'Zimmerman and the Spinning Sphere', p.212.

[205] This objection to Lewis' defence is due to Zimmerman in his 'One Really Big Liquid Sphere', p.213.

L1: If there is matter at one spacetime point, and if the vector associated with that matter points in a certain direction, then at the next moment matter will appear at the place toward which that vector was pointing.

But in the worlds in which Cartesian physics obtains, every vector field will satisfy this law. In addition, Lewis's law does not account for the possibility that there might exist different types of matter.[206] In such a case, the law would need to be restricted such that the correct vector within homogeneous stuff of kind H points to more H-stuff. For example, as Zimmerman points out:

We are, in all the essentials, back to C.D Broad's original example of a 'homogeneous incompressible fluid with no solid bodies in it'; only now, as a matter of physical law, the stuff fills the universe. Still, as Broad said, it might be at rest or it might have currents in it. Either you deny that there really are two possibilities here, or you give up the metaphysics of temporal parts (at least as a necessary truth about how things persist). Or you give up Humean supervenience about causation.[207]

What we have at this point are these three premises;

P1: Homogeneous substances in various states of internal motion are possible.

P2: It is possible that there might have been a world that, as a matter of at least physical necessity, is full of such substances.

P3: There are worlds of the sort posited in (P2) in which only one sort of stuff can (as a matter of physical necessity) exist.

Lewis has shown, by way of vectorial qualities, that he can retain both the thesis of temporal parts and Humean supervenience, whilst granting (P1). However, on this objection he cannot can retain both perdurantism and Humean supervenience, whilst granting (P2) and (P3). However, as *ceteris paribus* (P2) and (P3) represent genuine

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[206]Descartes entertained this notion. See his *Philosophical Letters*, ed. and trans. Anthony Kenny (Minneapolis: University of Minnesota Press, 1981[1639]), p.63, *Letter to Mersenne*, 9th Jan 1639.

[207]Zimmerman, 'One Really Big Liquid Sphere ...', p.214.

possibilities, RDA remains a threat to spatiotemporally based perdurantism - despite the efforts of the defence from vectorial qualities.[208]

In this section, I have examined several responses to rotating disc arguments. I have argued that both the no difference defence and the idea that motion is nonsensical in RDA contexts come at considerable cost. That cost is the abandonment of our intuition that there really is a difference in these cases. I have argued that this intuition is one that we ought to retain. I then proceeded to examine certain supplementations of the Humean basis, proposed as defences against RDA. I argued that none of these supplementations succeed. Instantaneous velocities are discounted due to their inability to capture instantaneous states of motion. I also argued that instantaneous velocities lead to circularity because states of motion can only be characterised in terms of persistence. Centripetal forces dismissed for the same reasons as instantaneous velocities. Relativistic effects suffer from the same circularity, and falter on the issue of the loneliness/accompaniment of the spheres. Vectorial qualities suffer a related fate to relativistic effects; they will not succeed as a defence against RDA in contexts where homogeneous stuff is everywhere. What remains is to examine one final supplementation – the notion that what is missing here is causation.

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[208] I have one more worry about the defence from vector-like qualities. Vectors must be *of* some quantity. What are Lewis's vectors, vectors of? Quantities such as momentum, force and velocity have vectors associated with them because they have magnitude and direction. What can we say about a vector field associated with matter itself? Does matter have magnitude and direction? Perhaps we can grant that the vectors posited here are distinct from those that accompany velocities (for if they are not all of the associated problems with velocities will recur). I leave this interesting question to the reader, but note that some account is due here, of why a vector associated with the propagation of matter is distinct from those with which we are more familiar.

3.3 Defence from causal perdurantism

As we have seen, various attempts have been made to supplement continuity in order to render it satisfactory. Some have advocated the addition of a 'sortal rule',[209] whilst others have called for a 'compositional criterion'.[210] The second variant of perdurantism (causal perdurantism) is another such supplementation. The causal account subsumes SQC, but emphasises the role of causal relations between temporal parts. Causal perdurantism is another response to Zimmerman's challenge. It attempts to locate the required difference in the sphere-stages' relations to one another. It is Armstrong's reason for putting RDA as an objection to continuity-based accounts of identity. His intention is to show that causation succeeds where continuity fails – it can differentiate between rotation and stasis. In this section, I will outline this defence from causal perdurantism. I will have much more to say about the causal account of identity in chapter four, and so here, I offer only a brief sketch of the position.

According to the causal perdurantist the identity through time of material objects consists in the holding of causal relations of an *appropriate* kind between temporal parts, existing at different times. As Armstrong puts it, the non-overlapping temporal parts of the one particular are welded together to constitute the single thing that exists through time by means of immanent-causal relations among those temporal parts, where immanent causation is taken to be the "actual bringing into existence of

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[209]Hirsch argues that spatiotemporal continuity must be supplemented with qualitative continuity and sortal coverage. His sortal rule is this: A sufficient condition for the succession S of object-stages to correspond to stages in the career of a single persisting object, is that: (1) S is spatiotemporally continuous; (2) S is qualitatively continuous; and (3) there is a sortal rule F such that S is a succession of F-stages. *The Concept of Identity*, p.10. See Oderberg's *The Metaphysics of Identity Over Time*, p.24 for criticisms of Hirsch's sortal rule.

[210]Quinton, *The Nature of Things* (London: Routledge and Kegan Paul, 1973).

later by earlier temporal parts."[211] For Armstrong, causal relations are what matters in persistence. As he explains:

If we are looking for relations to bind together the spatial parts of a thing so that it constitutes a thing of a certain sort, then, in general, we must appeal to different relations in the case of different sorts of things. But there is one relation which seems to be of quite peculiar importance in the case of the spatial parts. It is causation. In the case of solid objects, and particularly in the case of organisms, reciprocal causal relations between the spatial parts are all-important. By contrast, in the case of identity through time it is fashionable to set great store by spatiotemporal continuity. Again, however, I believe that we ought to set greater store by causal relations.[212]

Armstrong's response to RDA forms the basis of his causal perdurantism. The difference between the rotating and stationary spheres can be located in the immanent causal relations between the spatial and temporal parts of those spheres. So:

If the sphere is stationary, then the phases of the eastern portion from t_1 to t_2 will bear to each other that particular causal relationship which is required for phases of the same thing to constitute phases of the same thing. In particular, the existence of the earlier phases will be nomically required for the existence of the later phases in a way that will not be so for different temporal phases of spatially separate portions of the sphere. If the sphere is rotating, the causal relations will at once be different.[213]

Here we can see that Armstrong alludes to *that particular causal relationship* that temporal parts of a thing must bear to each other if they are to count as stages of the same object, that is, if they are to be genidentical. Clearly more must be said about the nature of the causal relation that results in genidentity. In chapter four I will turn to a discussion of what this causation might look like. However, as a brief introduction to that discussion we can say that for Armstrong, this causation is tied to nomic necessity.

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[211] Armstrong, *A World of States of Affairs*, p.74. I will have more to say about immanent causation in a later section of this chapter (§3.4).

[212] Armstrong, 'Identity Through Time', p.74.

[213] Ibid., p.77.

Armstrong sees this causation as neo-Humean in nature, however unlike Hume he maintains that this nomic connection is something over and above mere regularity. In particular, nomic connection is a regularity determined by a relation between universals. Only a

causal connection *so conceived* seems capable of welding different phases of the same particular much more closely together than mere spatiotemporal continuity.[214]

Although the earlier phase of an object is generally one of the nomically necessary conditions for the existence of the latter phases of that object, often it is absolutely nomically necessary. This is not required, because sometimes an earlier phase might be nomically necessary *in a given situation.*[215] The preceding phases of a thing are a necessary part of the total cause, which brings succeeding phases to be. In summary:

All this paves the way for the suggestion that, for most sorts of things at least, this causal relation between the phases is a logically necessary condition for the identity of that thing through time.[216]

Swoyer puts the position like so:

There is a causal, or more generally, lawful connection between the relevant things. The features that an object has at one time are partly determined by the features that it has at earlier times. ... The key is the

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[214]Ibid., p.75.

[215]Ibid. Armstrong explains by way of the following example, "Given the concrete situation, the recent existence of this desk I write on is nomically necessary for the current existence of this desk ... [Or, consider room a minute ago without the desk] It is nomically impossible that in that situation a desk should come to be in my room now having the same properties as the original desk. In all probability, it is nomically impossible that in that situation a desk should come to be in my room now having rather similar properties to my desk."

[216]Ibid.

existence of lawful relationships between the properties of the different stages of a single object, and sometimes these may simply involve the persistence of properties.[217]

Causal perdurantism is not an attempt to diminish the role of spatiotemporal continuity in the persistence of material objects.[218] However, even if it does turn out that the persistence of things is, *in fact*, always accompanied by continuity, it is reasonable to regard causation as basic here. We can therefore use *it* to explain that continuity.[219] The perdurantist sees continuity as accompanying causal connection for:

> The temporal parts of an ordinary thing that perdures through time are united as much by relations of causal dependence as by qualitative similarity. In fact, both work together: the reason the thing changes only gradually, for the most part, is that the way it is at any time depends causally on the way it was at the time just before, and this dependence is by and large conservative.[220]

Causality seems to guarantee SQC, as any causal chain that links stages such that they form a single object must itself be spatiotemporally continuous. As was shown in chapter two (§2.5) continuity is neither necessary nor sufficient for identity. Causation, it is claimed, when combined with continuity will provide this stronger condition.[221] This is because a continuing thing must 'grow out of' its past.[222]

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[217] Swoyer, 'Causation and Identity', p.601. Swoyer's point about the persistence of properties and its relation to the persistence of material objects points the way to the discussion of chapter five, where Douglas Ehring's account of causation as trope persistence is discussed.

[218] At least, Lewis does not want to downplay the role of continuity, as he thinks continuity is necessary, if not sufficient for identity. As I have said, Armstrong disagrees and maintains that continuity is not necessary either.

[219] Swoyer, 'Causation and Identity', p.602.

[220] Lewis, *Plurality*, p.218.

[221] See Armstrong's *A World of States of Affairs*, pp.104-5, and Lewis's *Philosophical Papers: volume II*, p.72-3, for more detailed expositions of causal perdurantism.

[222] Armstrong, *A World of States of Affairs*, p.105.

Here Armstrong follows the lead of David Hume to a certain extent.[223]

Armstrong maintains that Hume knew the value of causation in regard to identity, but downgraded it. Hume knew causation was important to relational accounts of identity, however he downgraded causation to the extent that he was led to neglect causation as the cement for different stages of the same thing.[224] Nevertheless, causal perdurantism is explicitly expressed by Hume in the following three doctrines. First, things persist through change (to the extent that they do) in virtue of having different temporal parts at different times. Second, a series of temporal parts constitutes a persisting thing only if later temporal parts are causally dependent upon earlier ones in appropriate ways. Third, causation is not a fundamental relation between events, but is something that supervenes upon other properties and relations.[225] This is seen in Hume's comment that:

'Tis, therefore, on some of these three relations of resemblance, contiguity and causation, that identity depends; ... Whatever changes he endures, his several parts are still connected by the relation of causation.[226]

Bertrand Russell also posits a certain causal relatedness between object-stages over and above mere spatiotemporal and qualitative continuity. Russell uses causation as a means to mark out pseudo from genuine persisting objects. He argues that

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[223] Note that just what Hume's views about identity were, is a controversial issue. Ultimately, he seems to have been an advocate of fictional identity, (something with which Armstrong would not agree).

[224] Armstrong, 'Identity Through Time', p.75.

[225] See Hume's *Treatise* section vi, pp.251-263.

[226] Ibid., pp.260-261.

only causation will tell us which series of event-like object stages constitute objects and which do not.[227] We can express this point in this manner:

[T]hose series of thing-stages that are histories of persisting things, genuine continuants, are distinguished from series that are not, that is, series made up of stages from histories of different things, by the fact that what properties are instantiated in later stages of a genuine history is a function of, among other things, what properties were instantiated in earlier stages of it.[228]

Russell grounds his causal perdurantism in his law of quasi permanence. This law is designed to explain the success of our common sense notion of 'things' and our physical notion of 'matter'. A thing or a piece of matter is not to be regarded as a single persistent substantial entity, but rather as a string of events having a certain kind of causal connection to one another. The kind of causal connection Russell has in mind is expressed by the law of quasi-permanence. It falls under a causal law according to which:

Given an event at a certain time, then at any slightly earlier or slightly later time there is, at some neighbouring place, a closely similar event. ... When 'substance' is abandoned, the identity, for commonsense, of a thing or a person at different times must be explained as consisting in what may be called a 'causal line'.[229]

For Russell a persisting thing is a 'string of events, connected by certain causal relations, and having enough unity to deserve a single name'.[230] Persisting objects are taken to be causal lines. The trajectory of something through time is a causal line if it

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[227] Wesley Salmon has argued against this claim. See Hans Reichenbach's *Philosophy of Space and Time* (New York: Dover, 1958), pp.147-9 for discussion of causation's role in marking the distinction between pseudo and genuine world-lines.

[228] Shoemaker, *Identity, Cause and Mind*, p.239.

[229] Russell, *Human Knowledge* (New York: Simon & Schuster, 1948), p.476.

[230] Russell, *Philosophy* (*aka An Outline of Philosophy*) (New York: Norton, 1927), p.119.

does not change too much and if it persists in isolation from other things. A series of

events that displays this kind of similarity is said to display quasi-permanence.[231] Or:

> A causal line may always be regarded as a persistence of something, a person, a table, a photon, or what
> not. Throughout a given causal line, there may be constancy of quality, constancy of structure, or gradual
> changes in either, but not a sudden change of any considerable magnitude.[232]

The identity of commonsense things is explained as consisting in causal lines. We

recognise a thing by qualitative similarity, but this does not *define* identity through time,

for that is the role of causal lines. Identity through time consists in the fact that the

different temporal parts of that thing are all parts of the one causal line.[233]

Causal lines are also important to inductive reasoning. A causal line is a

temporal series of events so related that, given some of them, something can be inferred

about the others, without regard to what is happening elsewhere.[234] That is, causal lines

of quasi-permanence warrant and validate inductive scientific inferences. As a causal

line must always be regarded as the persistence of something, we can see that Russell is

a thoroughgoing causal perdurantist.

How exactly does causal perdurantism provide a defence against RDA? Put

simply, the difference between the rotating and the stationary spheres is a difference

between the causal relations among their stages. Differences between sphere states

amount to differences in the immanent-causal relations between their stages. To

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[231] In his *Human Knowledge*, p.475 Russell puts forward Newton's first law of motion as an example of a
causal line that displays quasi-permanence, for according to that law, an object will continue in motion
unless acted upon by a force. This implies that the object will continue to have the relevant properties in a
continuous fashion.

[232] Ibid., p.477.

[233] Armstrong accepts Russell's analysis based on causal lines, but adds that we should add to this that a
causal line should be information preserving. For details see his *A World of States of Affairs*, p.105-6.

elaborate, imagine the sphere with a segment removed.[235] If the sphere is stationary, the empty space will remain stationary because 'nothing comes from nothing'. If the sphere rotates, the empty space will move around for the same reason. We *could* say that the sphere remains stationary while the empty space rotates (which is possible), however such an analysis requires extremely unlikely annihilations and creations at every instant, something which we do not think is possible. Here is a summary of the causal response to RDA:

A relational view [SQC] can appeal to causality here as a means of differentiating the two cases, though it will certainly have to be causality conceived of in a non-Humean manner. If the sphere is stationary, then the phases of the eastern portion from t_1 to t_2 will bear to each other that *particular causal relationship* which is required for phases of the same thing to constitute phases of the same thing. In particular, the existence of the earlier phases will be nomically required for the existence of the later phases in a way which will not be so for different temporal phases of spatially separate portions of the sphere. If the sphere is rotating, the causal relations will at once be different.[236]

There are three points to make about this passage. First, it specifies that the causal relation needed to make a difference must be of a particular kind. Second, it also specifies that this causation must be non-Humean. In chapter four I will return to this

[234] Russell, *Human Knowledge*, p.477.

[235] This elaboration is drawn from Armstrong, 'Identity Through Time', p.77.

[236] Armstrong, 'Identity Through Time', p.77 (emphasis added). This response sounds intuitive. It is supported by the fact that different counterfactuals will be true of the successive stages of the rotating sphere than of the stationary sphere. Suppose that between t_1 and t_2 the sphere rotates through 180°. Then it will be true (assuming that the sphere is made of scratch-retentive material) that if at t_1 the eastern portion of the sphere had had a scratch of a certain shape on it, and the sphere had been otherwise unscratched, then at t_2 the western portion of the sphere would have had a scratch on it, and the sphere would have been otherwise unscratched. Whereas if the sphere had been stationary between t_1 and t_2, a *different* counterfactual would hold, namely that if at t_1 the sole scratch on the sphere had been on the eastern portion, then at t_2 it would also be the case that the sole scratch on the sphere is on the eastern portion. It seems natural to suppose that the difference in the counterfactuals is picking out some

point in detail. The question there will be – why does Humean causation fail to make the difference, and does non-Humean causation avoid this difficulty? However, before turning to the nature of this causation, I want to turn briefly to three notions that are important to the causal perdurantist – those of 'appropriateness', 'immanence' and 'circularity'.[237]

Causation does seem to be conceptually useful for binding together different phases of the same thing. The popularity of causal perdurantism is hardly surprising given that few today subscribe to a substantival view of identity. Most hold a relational view, according to which the identity of any two (P_1, P_2) non-overlapping, temporal phases of a particular, P, consists in the fact that P_1 and P_2, or the parts of which they are composed, (themselves particulars), are related in various ways to each other and to further particulars. The holding of some of these relations constitutes what it is for P_1 and P_2 to be different temporal parts of P.[238] Clearly, the causal relation is the obvious candidate for many - but what *sort* of causal relation?

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difference in the causal relations in the two cases. (A point made by Shoemaker in his *Identity, Cause and Mind*, p.244).

[237] We have seen that the causal perdurantist puts causation at the heart of her response to RDA - but what of the doctrine of Humean supervenience? Some are of the opinion that even if causal relations *do* make the difference in RDA, Humean supervenience will still fail. For example, "Suppose for instance we are comparing two worlds, in all other respects just alike in their distribution of qualities, one of which contains a stationary disc of homogeneous matter, while the other contains an exactly similar disc which rotates... Then it seems that the arrangement of qualities in the two worlds will be identical. *Ex hypothesi* the worlds differ, so that whether we locate the difference at the level of identity or of causation or of counterfactuals, we seem still to have a counter-example to HS." Robinson, 'Matter, Motion and Humean Supervenience', p.402.

[238] This characterisation is due to Daniel Kolak & Raymond Martin's 'Personal Identity and Causality: Becoming Unglued', *American Philosophical Quarterly* 24 (1987) pp.345-6.

3.4 Appropriateness, immanence & circularity

In attempting to supplement spatiotemporal and qualitative continuity with causation, in order to solve the RDA, the causal perdurantist is on dangerous ground. This danger is the threat of circularity. I have already mentioned two charges of circularity against perdurantism. One was introduced earlier in this chapter (§3.2), and the other in a previous chapter (§2.2). Recall that one stems from using states of motion as a fix for RDA. The other was aimed at the part-hood relation itself. In this section I will revisit these two charges, in order to distinguish them from a third. This final kind of circularity will become the focus of chapter four, and it stems from the nature of the causal relation said to unite temporal parts, such that they are parts of a persisting object.

States of motion and circularity – reprise

First, we might think that causal perdurantism is circular when it comes to homogeneous objects in motion. This kind of circularity was discussed earlier in this chapter (§3.2). It arises from attempts to use states of motion as a fix for rotating disc arguments. This circularity was a problem for spatiotemporally based perdurantism, rather than causal perdurantism, and is the charge that states of motion cannot be used to solve rotating disc arguments because such states presuppose certain facts of identity. The idea here is that different momentary states of continuants will not be causally connected in the ways claimed by the causal perdurantist unless they are construed as including states of motion. However, unfortunately, the concept of motion must be explained in terms of persistence.[239] Or:

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[239] For more discussion of this point see Shoemaker's *Identity, Cause and Mind*, p.255.

Let E_1 be the eastern portion of our sphere at t_1, E_2 the eastern portion of our sphere at t_2, and W_2 the western portion of our sphere at t_2. In the case where the sphere is stationary, the state of E_2 at t_2 is counterfactually dependent on the state of E_1 at t_1, and it seems reasonable to assume that this counterfactual dependence is grounded in causal relationships. Here, of course, E_1 and E_2 are identical. Likewise, in the case in which the sphere is rotating, and rotates 180° between t_1 and t_2 the state of W_2 at t_2 is counterfactually dependent on the state of E_1 at t_1, and again, it seems reasonable to assume that this relation is grounded in a causal relationship. Here E_1 and W_2 are identical. But the causally relevant state of E_1 at t_1 cannot consist simply in its having a certain shape, size and composition, for such properties are ones that E_1 has in both cases (that is, both when the sphere is stationary and when it is rotating) and so cannot account for the difference between the counterfactuals that hold in the one case and those that hold in the other. It would seem that the causally relevant state of $E1$ at $t1$ will crucially involve in the one case the fact that $E1$ was stationary and in the other that $E1$ had a certain angular velocity. If the causally relevant properties include states of motion, then it seems the attempt to analyze cross-temporal identity in terms of causality will be circular.[240]

Interestingly, Shoemaker attempts to rescue states of motion as a fix for RDA. The rescue mission relies on an analysis of instantaneous velocities and immanence. Rightly, he is dubious about this fix. His worry is that his apparent dissolution of circularity, 'does so surreptitiously in its reliance on the notion of an 'appropriate' sort of causal relation'.[241] I think that this is exactly so. An analysis of the meaning of 'appropriateness' in this context cannot be deferred.

'Appropriate' causal connections?

Put simply, it seems that not any old causal relation can do the requisite work in RDA contexts. The causation must be of an *appropriate* kind. Many characterisations of causal perdurantism build in this appropriateness condition, for example,

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[240] Shoemaker, *Identity, Cause and Mind*, p.245.

[241] Ibid., p.246-7.

... it is a requirement for the cross-temporal identity of ordinary sorts of continuants that successive stages or phases in their histories stand in *appropriate* causal relationships, and that there is a good sense in which the holding of these relationships may be said to be constitutive of the identity.[242]

Or take Armstrong's claim that "we will expect that there is a reasonably *salient* relation that will sort the different temporal parts of such objects as animals and stones into what are at least roughly equivalence classes."[243] Or consider Lewis, contemplating the nature of his own survival, such that his wish to see his book completed is granted, and claiming "that will happen only if the *proper sort* of causal continuity binds together my present stage with the one that finishes the book."[244] The sentiment is that whatever the nature of the causal relation that connects temporal parts, it must be of an appropriate kind. However, not all agree that the causation inherent in causal perdurantism *is* in need of further analysis. Take for example Denis Robinson's reflection that:

Perhaps the requisite kind of causal dependence differs for each different kind of thing or stuff. But the task of investigating our concept of material identity need not be seen as requiring a fully detailed characterisation of these relations.[245]

Alternatively, take Derek Parfit's insistence that psychological continuity, or his 'relation R' generates personal identity. Exactly what the extension of the term 'relation R' is matters not to Parfit as he places no restriction on the type of causation that is capable of producing identity.[246]

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[242] Ibid., pp.237-8. (emphasis added).

[243] Armstrong, *A World of States of Affairs*, p.103. (emphasis added).

[244] Lewis *Plurality*, p.126. (emphasis added).

[245] Dennis Robinson, 'Re-Identifying Matter', *Philosophical Review*, 91 (1982) p.330.

[246] Derek Parfit, 'Rationality and Time', *Proceedings of the Aristotelian Society* 84 (1984) pp.47-82.

I disagree with Parfit and Robinson on this point. It *is* important how we choose to characterise the causation of causal perdurantism.[247] I say this for two reasons. First, causal accounts of phenomena such as memory and perception do *not* generally work from the assumption that any account of causal connection will do. It is at least plausible therefore, to think that this restriction will also apply to a discussion of identity. Second, failure to characterise (carefully) the kind of causation involved in identity will subject causal perdurantism to the danger of circularity. The kind of causation involved must be free of facts of identity, if it is to itself be implicated in identity. Identity-giving causation must not be analysed in terms of identity itself. Before I turn to a discussion of this kind of circularity, I want to outline another common charge of circularity, one that I do not find persuasive.

Immanence and circularity

The second sort of circularity might be though to stem from the immanence or 'remaining within' of the causal connection said to unite temporal parts such that they are temporal parts of the one object. If we know anything about this causation, we know that it must be immanent rather than transeunt.[248] Immanent causation is causation that

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For a good discussion of Parfit's views see McKinnon and Bigelow's 'Parfit, Causation and Survival', http//www.personal.monash.edu.au/~ngmck/parfit.htm (1999).

[247] I do not mean to suggest that no one has attempted to specify the nature of this causal relation. A good attempt can be found in Douglas Ehring's 'Motion, Causation and the Causal Theory of Identity', *Australasian Journal of Philosophy* 62 (1991) pp.180-194.

[248] This terminology originated with W.E Johnson. There he defines transeunt causation such that "the cause occurrence and the effect occurrence are referred to as different continuants, whereas in immanent causality the cause occurrence and effect occurrence are attributed to the same continuant." For early discussions of the concept of immanence see W.E. Johnson's *Logic: Part III*, (Cambridge: Cambridge University Press, 1964 [1924]), especially chapters vii, ix.. See also: C.D. Broad's *Perception, Physics,*

does not involve interactions between distinct particulars, and usually works to preserve that particular's properties. More specifically:

A series of thing stages is 'immanently connected' if its later stages develop from its earlier ones in accordance with the laws of immanent causality that are, as it were, built into the nature of the properties instantiated in the states of the series (and the stages of other series with which it interacts).[249]

We might think that immanent causal connection is a necessary condition of series of thing stages being the history of a persisting thing. Immanent causation is to be contrasted with transeunt causation, or 'a going across' by which one thing influences another.[250] To make the distinction clear:

Certain wholes maintain their stability by the interactions of their proper parts. ... That is transeunt causality. But it may also be that there is a form of causality which remains confined to a single particular and that, further, does not proceed by interaction between sub-particulars. This will be immanent causality.[251]

I will not be concerned with the relation between immanent and transeunt causation, or whether one might be reducible to the other.[252] What I am concerned with is the idea that immanence might lead to circularity. The problem is this. We might think that if perdurantist plans to use immanent causation to explicate identity through time, they

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and Reality (Cambridge: Cambridge University Press, 1914), pp.102-103; and Hermann Lotze's Metaphysics, Bernard Bosanquet (ed.), (Oxford: Clarendon, 1887), p.116.

[249] Shoemaker, Identity, Cause and Mind, p.254.

[250] Johnson, Logic, chapter vi.

[251] Armstrong, A World of States of Affairs, p.73-74. Armstrong contends that such causation occurs in cases of spontaneous radioactive decay.

[252] Although I will mention that for Armstrong, "immanent and transeunt causation are naturally taken to be different species of relation falling under the same genus", A World of States of Affairs, p.106. See Dean Zimmerman's 'Immanent Causation', in James Tomberlin (ed.), Philosophical Perspectives vol II Mind, Causation and World (Boston: Blackwell, 1997), for a discussion of the views of Lotz, Johnson and Broad on the relation between these two types of causation.

cannot define immanent causation in Johnson's manner. That is, they cannot define immanence as 'remaining within' causation, for 'it is precisely the conditions under which stages constitute a single persisting thing that the friends of temporal parts must spell out in terms of immanent causation'.[253]

It is not difficult to feel persuaded by this argument.[254] However, I would argue that it results merely from the way in which immanence is defined. For example, phrases such as 'it is causality which involves 'a thing replacing *itself*,[255] and 'the common-sense of immanence ...can be defined in terms of the holding of causal laws that take as 'data' only qualities that fall within the boundaries of *a single persisting thing*.[256] This kind of definition starts to look circular because it invokes a persisting particular as the location of the causal processes that are said to constitute that persisting particular. Or, more explicitly:

> ... we can say that the causal connection between thing-stages is appropriate just in case they belong to a series of thing-stages that is immanently connected. But ... this will reintroduce the circularity we were out to avoid; the notion of being immanently connected was explained in terms of the notion of immanent causality, which in turn was explained in terms of the notion of persistence, or cross-temporal identity.[257]

I want to argue that this circularity charge is benign. We should say that *if* two temporal parts are appropriately causally connected, such that they are parts of the single continuant, *then* we are warranted in referring to that causation as immanent.

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[253] Zimmerman, 'Immanent Causation', p.270. Zimmerman attempts to redefine immanence in order to overcome this alleged circularity.

[254] Sydney Shoemaker is so persuaded that he despairs "Is there any hope of defining the required notion of immanent causality, or of the required notion of and 'appropriate' causal connection between thing-stages, without the use of the notion of persistence? I do not think so." *Identity, Cause and Mind*, p.255.

[255] Armstrong, *A World of States of Affairs*, p.105 (emphasis added).

[256] Broad, *Perception, Physics, and Reality*, pp.104-105.

[257] Shoemaker, *Identity, Cause and Mind*, p.255.

This response is reminiscent of one already given to another charge of circularity. That sort of circularity was outlined in chapter two (§2.2). There I said that we might think perdurantism is circular because we think that a temporal part of an object can only be individuated by reference to its relative position *within the object of which it is a part*. The idea there was that the part-hood relation can only be made sense of in the context of a stipulated persisting whole. I argued that this kind of circularity is not a genuine threat to perdurantism as it results from a simple error in emphasis, or order of argumentation. Similarly, circularity thought to stem for the notion of immanence results from a definitional error, and can be easily avoided.

In this section I have emphasised the importance of the concept of appropriateness to causal perdurantism, by revisited two charges of circularity that are commonly made against perdurantism. The first applies to continuity-based perdurantism and is persuasive. It seems that states of motion cannot be used as a fix for RDA if circularity is to be avoided. However, the second charge is unsuccessful. A worry about circularity stemming from the immanence of causal connections between temporal parts is not persuasive, in the same way that the earlier worry about part-hood is not persuasive.

3.5 Summary

In this chapter I have attempted to do several things. First I outlined rotating disc arguments as a challenge to continuity-based perdurantism. I then argued that two responses to RDA, (the no difference defence and the idea that motion makes no sense in RDA contexts), are unsatisfactory, as they require us to abandon our intuition that there just is a difference in these cases. The chapter proceeded to examine some proposals for supplementing continuity. I argued that none of these supplementations

succeed. The final supplementation – causal perdurantism was then introduced. At the close of this chapter I revisited two charges of circularity that are commonly made against perdurantism. I argued that circularity does appear when states of motion are used as a fix for RDA. I also argued that charges of circularity based on part-hood and immanence are specious.

So, we move to a final charge of circularity, one that rests on the causal relation itself. I have said that causal perdurantism is an attempt to supplement continuity such that it can distinguish between states of motion and stasis for homogeneous objects. I have also said that the causal perdurantist must explain what is meant by an 'appropriate' causal relation between temporal parts, and that this explanation must not make reference to facts of identity. In the following chapter I will argue that causal perdurantism cannot provide an adequate response to rotating disc arguments without becoming circular in this last sense.

Chapter 4: Theories of causation and causal perdurantism

This chapter investigates several theories of causation, and their application to causal perdurantism.[258] Recall that causal perdurantism attempts to exploit the 'appropriate' nature of the causal relation between temporal parts in order to avoid rotating disc arguments. I have argued that the success of the causal account in achieving this aim will turn on an elaboration of just what these 'appropriate' causal connections might be. My measure of success in this regard will be a theory's ability to successfully resolve RDA. 'Resolving' will be measured in the following way. The candidate theory of causation must satisfy these two desiderata.

D1. The theory of causation, when applied to causal perdurantism must be able to rule out unwanted pseudo-identities. The account of identity and homogeneous motion that emerges from the theory of causation must not lead to the conclusion that all spatiotemporal parts of the sphere are identical, and

D2. The theory of causation must be able to be applied to the causal account of identity *without* falling prey to circularity. That is, it must not assume facts of identity in its analysis of the causal relation.

As has already been pointed out, (§3.3) in order to differentiate between rotation and stasis, the theory of causation must be able to pick out genuine identities within the homogeneous object. I will argue that all of the causal theories presented fail on either D1 or D2. I take this to be a *prima facie* case against causal perdurantism. I

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[258] Some have though the task too difficult. Take for example Shoemaker's comment that "I shall not attempt here the probably impossible task of giving a general and non trivial characterization of a kind of causal dependence, the holding of which between successive thing-stages is always necessary and sufficient for their belonging to the same continuant." *Identity, Cause and Mind*, p.247.

will argue that several major theories of causation, when put to work within causal perdurantism, cannot avoid RDA without becoming circular. However, in order to defend this view, it is necessary to canvass these theories of causation and their respective applications to RDA contexts. As we will see, none of these accounts are successful.

In the first section I examine several law-based, or nomic theories of causation. Those theories considered include; a broadly Humean theory, according to which causal laws are identified with regularities, two theories whereby laws are seen as being probabilistic and a broadly non-Humean nomic theory. The idea here is to investigate just which, (if any), of these nomic theories can be successfully coupled with causal perdurantism. I will conclude that not one of these nomic causal theories is equal to the task. That is, not one of them can fill out causal perdurantism such that it avoids RDA. Specifically, each of them can either be shown to be circular, or shown to fail in demarcating genuine identities from pseudo identities. But firstly, to a theory of causation, according to which laws are Humean in nature.

4.1 Laws of nature and rotating disc arguments

Humean regularities

The Humean notices that causes and effects are constantly conjoined or associated in regular sequences. She then analyses causation as derivative on such regular sequences.[259] This idea of regularity, central to the Humean position, marks the theory

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[259] I am ignoring the psychological theory often attributed to Hume. That is, the view that the experience of the manifestation of causal power and the apparent necessity of effects is nothing but psychological disposition produced by 'habits of the mind'. For a good discussion of this facet of Hume's account see Haré and Madden's, *Causal Powers: A Theory of Natural Necessity* (Oxford: Blackwell, 1975). p.27.

as generalist. That is, according to such a generalist theory, judgements regarding singular token instances of causation are in fact inferred from general rules applying to types of causal regularities. So the Humean relies on the notion of type or kind to formulate her theory of causation. To say that A causes B commits us to the claim things sufficiently like A will cause things sufficiently like B. The theory is then supplemented by certain singularist components - namely, priority and spatiotemporal contiguity.[260] For the Humean, causation is a matter of patterns or laws of nature, but these laws are nothing but regularity, or constant conjunction. The Humean construes laws as nothing other than empirically establishable regularities. We can formalise the regularity theory of laws like so; L is a statement of a law of nature if and only if:

(i) L is universally quantified;

(ii) L is (omnitemporally and omnispatially) true;

(iii) L is contingent; and

Hume appears to argue explicitly that first, causation does not consist in a necessary connection between cause and effect, and second, causal relations cannot be known *a priori*. I say *appears* because this orthodox interpretation of Hume on causation no longer finds univocal support. (For alternative interpretations of Hume on necessary causal connexion, powers and the regularity theory of laws see: Costa, 'Hume and Causal Realism', *Australasian Journal of Philosophy* 67 (1989) pp.172-90; Don Garrett 'The Representation of Causation and Hume's Two Definitions of "Cause"', *Nous* 27 (1993) pp.167-90; Galen Strawson *The Secret Connexion: Causation, Realism, and David Hume*, (Oxford: Clarendon Press, 1989) and John P. Wright, *The Sceptical Realism of David Hume*, (Minneapolis: University of Minneapolis Press, 1983).

[260] Or at least contiguity was thought by Hume to warrant mention if only conditionally. Hume was open to further scientific developments (perhaps the vindication of action at a distance), as can be seen in this passage - "We may therefore consider the relation of CONTIGUITY as essential to that of causation; at least may suppose it such, according to the general opinion, 'till we can find a more proper occasion to clear up the matter." *Treatise*, p.75.

(iv) *L* contains only non-local empirical predicates, apart from logical connectives and quantifiers.[261]

The Humean attempts to pick out the unrestricted or cosmic uniformities in nature. These Humean uniformities are supposed to correspond to laws of nature. Along with this comes the tenet that the empirical content of a statement of a causal relation is no more than a statement that events of the type of the cause are regularly precedent to events or states of the type of the effect. So to say that '*c* causes *e*' is to say no more than 'events of the type of which the cause is a token, are regularly succeeded by events of the type of which the effect is a token'. In Hume's words, a cause is an

... object, followed by another, such that all objects similar to the first are followed by objects similar to the second.[262]

Therefore, we can see Humeanism as the conjunction of these three claims. *c* causes *e* if:

(I) *c* and *e* are contiguous in space and time, or are linked by a chain, which exhibits such contiguity;

(II) *c* is precedent to *e*; and

(III) Events of the type, of which *c* is a token, are regularly succeeded by events of the type, of which *e* is a token.

Hume also focuses on the notion of resemblance, whereby "We may define a CAUSE to be an object precedent and contiguous to another, and where all the objects resembling the former are plac'd in like relations of precedency and contiguity to those

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[261] This definition is based on that given by Armstrong in his *What is a Law of Nature?* (Cambridge: Cambridge University Press, 1983), p.12.

[262] Hume, *Enquiry*, p.76.

objects, that resemble the latter."[263] So, the notions of resemblance between cause and effect, priority of causes, contiguity and regularity will mark out a theory of causation as Humean.

We can amalgamate the Humean theory of causation with causal perdurantism to form Humean causal perdurantism. On this account two temporal parts will constitute temporal parts of a persisting object if they are causally connected, or more specifically are constantly conjoined, resemble one another, and are contiguous in space and time. In fact, Hume himself offers such an account:

'Tis, therefore, on some of these three relations of resemblance, contiguity and causation, that identity depends; and as the very essence of these relations consists in their producing an easy transition of ideas it follows, that our notions of personal identity, proceed entirely from the smooth and uninterrupted progress of the thought along a train of connected ideas, according to the principles above explain'd.[264]

On this account, two temporal parts of an object are parts of one persisting object only if parts of that type are regularly found to be contiguous and constantly conjoined. We can say then, that for the Humean causal perdurantist,[265] temporal part, a, of type A, is the cause of temporal part, b, of type B if and only if,

I. a and b resemble one another in some way,[266]

II. a and b are contiguous or are linked by a chain of contiguous events,

III. a precedes b in time, and

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[263] Hume, *Treatise*, p.169.

[264] Ibid., p.260.

[265] See Ehring's 'Motion, Causation and the Causal Theory of Identity', p.185 for a fuller treatment of these Humean conditions.

[266] I do not have space here to investigate just what the resemblance between temporal parts must consist in. However, this resemblance had better not be merely the fact that the temporal parts in question resemble each other in that they are parts of one persisting object, for this will beg the question at hand. I

IV. every temporal part of type A is followed contiguously by a temporal part of type B.[267]

Can we use Humean causal perdurantism to avoid RDA? Take a portion a of our homogeneous sphere, which we know to be in the SE quadrant at time, t_2. We want to know whether or not portion a was in the NW quadrant at an earlier time, t_1. According to the Humean theory of causation, an a-type portion at t_1 will be a cause of another a-type portion at t_2 if and only if a-type portions at t_1 and a-type portions at t_2 are contiguously and constantly conjoined. We should note that if the sphere is rotating there certainly is a chain of contiguous sphere portions, which extends from the NW quadrant to the SE quadrant. However, as it turns out, rather than resolving RDA this contiguity, or regularity, has quite the opposite effect. Contiguity and regularity, when applied to homogeneous objects only serve to make matters worse.

Imagine a stationary sphere, which persists through time, say from t_1 to t_2. Now, take some portion of the sphere, a. We might formalise a regularity like so,

(i)$R\{(Fa\ t_1) \supset (Fa\ t_2)\}$,

where R marks the law as expressing a regularity, or constant conjunction and F denotes a certain complex property of a portion of the sphere, such as having a certain colour, shape, relative spatiotemporal position, momentum, velocity and so on.[268] Of course, 'a', here denotes the same portion of the sphere at different times. The regularity captures the fact that nothing has changed – the sphere is stationary.

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assume the Humean would cash out this resemblance in terms of qualitative similarity, where that quality is not just that a temporal part is a part of a certain whole.

[267] Again, it had better not be the case that two temporal parts are of the same type only if they are parts of the one persisting object, for this again would beg the question. Type-hood and class membership will have to be grounded in some other factor.

[268] Note that '$\supset$' is intended to symbolise a universal regularity.

However, this regularity cannot be distinguished from another - a regularity that holds between non-identical portions of the stationary sphere, say

(ii) $R\{(Fa\ t_1) \supset (Gb\ t_2)\}$,

where R marks the law as expressing a regularity, or constant conjunction, and F and G denote certain complex properties of two distinct portions of the sphere, a and b, such as having a certain colour, shape, relative spatiotemporal position, momentum, velocity and so on. This is a pseudo-identity; it marks regularity, contiguity and resemblance between *distinct* sphere portions at different times. But it is hard to see just in what, if anything, the difference between (i) and (ii) lies. The difference certainly does not inhere in regular, constant conjunction.[269] Recall that the sphere is homogeneous and continuous. This has the result that *any* given portion of the sphere, say portion a at t_1, is contiguous and constantly conjoined with a large range of *other* portions. However, given that contiguity and constant conjunction are the marks of causation, and causation is the mark of identity, we should conclude that all contiguous and constantly conjoined sphere-portions are identical. This means that there will be more causal connections and therefore more identities than are required. There are two problems with this promiscuity. First, it leads to absurdity. That is, in order to decide the facts of identity (and therefore the fact of rotation), we must somehow conclude that all sphere portions are causally connected to and therefore identical with, all others – but this just cannot be the case. Secondly, if all sphere portions are connected in such a way that they count as identical, no differentiation between rotation and stasis can be made. This is because determining facts of motion in this case depends upon differentiating

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[269] It looks like the difference might lie in the properties F, and G, but the only point of difference here is spatiotemporal position. Given homogeneity, two distinct portions do not differ in any other properties. But spatiotemporal position is only different here *because* the fact of motion (that the sphere is stationary) has been stipulated.

between genuine identities and pseudo ones. We might think that the reason that

Humeanism has failed in this case is that we have omitted the resemblance condition

from our characterisation of what is occurring within the sphere. But this will not do.

Because the sphere is homogeneous, every portion of the sphere will exactly resemble

every other. Resemblance is no help to the Humean in RDA contexts. The only

difference could be, that *a* and *b* are non-identical. But of course, that was the question

at hand.

We might think that the fact that Humeanism fails in RDA contexts just

shows that although causation might be necessary for two temporal parts to be parts of

the one persisting object it is in no way sufficient for it. This might explain why the

causal relations do not track the relevant identity facts for portions of the sphere. Put

simply, regularity, resemblance and continuity do not guarantee identity. In other words,

RDA shows us that:

Hume's definitions cast too wide a net. There are many pairs of events that are regularly associated,
contiguous and temporally ordered and which are associated by custom or habit and that are not causally
connected or that we do not to include among our set of causally connected events.[270]

The Humean owes us some story about which regularities will count as causal and

which will not.[271] This point becomes relevant to our purposes, for the reason Humean

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[270]Kenneth Clatterbaugh, *The Causation Debate in Modern Philosophy: 1637-1739*, (New York:
Routledge & Kegan Paul, 1999), p.205. This problem has led some neo-Humeans to reject the need for
perfectly uniform regularities. This strategy is inherent in some probabilistic theories of causation.
According to such a theory, $P(E/C) = 1$, (which captures the Humean, deterministic notion that every
effect has a sufficient cause), is replaced by the idea of indeterministic causation, according to which *not*
all causes are sufficient for their effects. For an example of this theory see Patrick Suppes' *A Probabilistic
Theory of Causality*, (Amsterdam: North-Holland, 1970), in which constant conjunction is replaced by
frequent conjunction. This type of law-based theory of causation will be discussed later in this section.
[271]I am ignoring another curiosity about Humeanism - that Humean uniformities might not be *necessary*
for causal laws. We might think this for a variety of reasons such as: (1). There could be laws of nature

theories of causation cannot distinguish between genuine and pseudo-identities in RDA context, is that they fail to demarcate 'appropriate' from inappropriate causal connections. Presumably, it is the appropriate causal connections that are hoped to 'make will the difference'. However, on the naïve regularity theory of laws, no such refinement is given. Humean uniformities are not sufficient for laws of nature, because accidental constant conjunctions do not ground any corresponding token causal sequences. That is, the Humean cannot adequately distinguish between regularities that constitute genuine laws of nature and those that make up merely accidental or non-causal regularities. What the Humean must do is somehow ground this difference if she is to avoid RDA.

One attempt to demarcate accidental generalisations from causal uniformities is due to John Mackie.[272] In Mackie's view of causation and its relation to laws and identity, we see a direct attempt to overcome some of these problems with

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that do not hold over all of space and time and therefore do not constitute Humean uniformities, (for discussion see Armstrong's *What is a Law of Nature?* p.24. (2) There could be probabilistic laws, which do not involve Humean uniformities. (3) It could be that something might produce a certain effect while something similar might not. As an example of this we can point to indeterministic or probabilistic causes such as those postulated by modern physics. Modern physics tends to suggest that many of the fundamental laws of nature do not spring from Humean uniformities, but in fact from probabilistic distributions. (There is much debate as to what makes such a distribution the manifestation of a probabilistic law.) The objection of course is that an irreducibly probabilistic law will *not* manifest itself in any Humean uniformity. (for discussion see Armstrong's *What is a Law of Nature?*, p.29. Of course it may be that there exist indeterministic regularities, but this question is beyond the scope of this discussion. For fuller discussions of this point: see Haré and Madden's *Causal Power*, chapter 2; and Chisholm's 'Law Statements and Counterfactual Inferences', *Analysis* 15 (1955) pp.97-105, who attempt to delineate accidental regularities from causal ones.

[272] Others have also made spirited defences. For example, J.J.C Smart, 'Laws and Cosmology' in Howard Sankey (ed.), *Causation and Laws of Nature*, (Dordrecht: Klewer, 1999), pp.161-169.

Humeanism, but one which retains the essential sentiment of Hume's theory.[273]

However, there is no sense in which Mackie holds the naive regularity theory of causation or the account of laws that attends it. Mackie turns his attention to the problem of sufficiency in an effort to make the difference between accidental and genuinely causal regularities. He does this because,

... if there are or can be regularities which are altogether accidental ..., it seems that their instances will count as causal by the regularity definition, while they would be intuitively set aside as non-causal.[274]

This is just what has happened in the case of the rotating disc argument. Certain regularities have counted as causal regularities (and therefore identities) when intuitively they should not. Perhaps Mackie's strategy to ground this difference can mean that Humeanism can successfully avoid RDA? The task is to draw a distinction between genuine laws of nature on the one hand, and merely accidentally, true universal propositions on the other. It is hard to see how a regularity theory of causation can achieve this.[275]

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[273] Mackie agrees with Hume on several counts. He holds, like Hume, that the sentiments that every event has a cause, and that any causal law or singular causal statement is an analytic truth, are simply not analytic. Mackie is rightly classed as a Humean due to his view that there are no logically necessary connections between the events themselves or between any intrinsic descriptions of them. In other words, the inference from observed event to another event as its cause or effect is never, in Mackie's view, deductively valid. (*Cement of the Universe*, pp.17-18).

[274] Ibid., p.196.

[275] For some clear examples of accidental generalisations, see W.C Kneale's 'Natural Laws and Contrary to Fact Conditionals', *Analysis* 10 (1950) pp. 226-31. Generally we do not want to identify laws with accidental generalisations because laws of nature seem to entail counterfactual conditionals, whilst contingent, accidental generalisations do not. For example, consider the accidental universal truth that 'all the coins in my pocket are shiny'. This clearly does not support the counterfactual 'if another coin had have been in my pocket it would have been shiny'. As Mackie points out in *Cement of the Universe* , pp.200-201, accidental regularities cannot sustain counterfactuals because they cannot be retained within the scope of the original proposition, and then be applied to a *possible* situation. This seems to suggest

Mackie's solution involves the introduction of what he calls 'laws of working'. These laws of working are contrasted with Mill's collocations. Mackie's system of laws is as follows.[276] We have on the one hand pure collocation statements that are true contingent universal statements about small systems. These collocation statements have a spatiotemporally limited application. In addition, we have certain derived laws that govern such systems. On the other hand, we have what Mackie calls 'basic laws of working', such as the Newtonian theory of motion and gravitation.[277]

However, in order to introduce his laws of working, Mackie must explain why it is that these laws carry necessity, and accidental generalisations do not. His answer is that laws of working are typically discovered by inductive and hypothesis-confirming procedures. However, initial conditions are discovered by complete surveys and are not inductively supported. We can check to see if a law of working is independent of collocations by changing the collocations and seeing if the law still holds. If it does, that law will sustain counterfactuals, whereas mere statements of collocations or initial conditions will not.

Mackie argues that the main error of the Humean regularity account of laws, is its conception of necessity. He argues that a new notion is required in order to explain why it is that basic laws of working carry necessity, and accidental regularities do not. Accordingly, he argues that things that interact causally have 'insides', or internal processes, which we do not or cannot, perceive. The necessary connections between these internal features of things are hidden from us. However, when we assert a natural law, we do not claim to know it as necessary. Rather, we *conjecture* the necessary

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that laws of nature deserve some stronger status than contingency. But Mackie denies this suggestion, p.199-204.

[276] Mackie, *Cement of the Universe*, pp.210-214.

[277] Mackie adds into this account mixed laws which are mixtures of laws of working and collocations.

connection, on the basis of external features. For this reason, Mackie calls for a

transcendent hypothesis, through which we (contra Hume) *are* licensed to posit

necessary connections.[278] Mackie concludes with the suggestion that we "advance

beyond a view of causation as mere succession when we conjecture that there really is

some causal mechanism underlying the succession and explaining it."[279] But what is this

causal mechanism? For Mackie the required mechanism is *persistence* itself. So, for

Mackie a singular causal sequence

... instantiates some pure law of working which is itself a form of partial persistence; the individual
sequence therefore is, perhaps unobviously, identical with some process that has some qualitative or
structural continuity, and that also incorporates the fixity relations which constitute the direction of
causation.[280]

Mackie concludes that the kind of necessity that needed, (that is necessity that can

support a probabilistic *a priori* inference), is facilitated by the qualitative or structural

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[278] What I have said above may sound a little strange given that I have also said that Mackie accepts
Hume's argument that there can be no logically necessary connection between cause and effect. This
apparent tension evaporates once we recognise that Hume and Mackie's conceptions of necessity differ.
Mackie accepts that there is no 'necessity 2.1', that is necessity which would support a deductively valid
a priori inference from cause to effect or vice versa. This is because we can never observe type a
necessity, which would support a deductively valid *a priori* causal inference. All we know is that
observable features of one event might *probabilify* a certain continuation or successor-event. However,
argues Mackie, this does *not* show that no observations will reveal a different type of necessity. Hume's
mistake is to confuse several kinds of necessary connection. The mistake is to think that causal producing
must involve necessity in terms of the *apriori* justification of inference. In opposition to this, Mackie
concludes that the inductive evidence that supports the laws justifies the use of the counterfactuals that
they appear to sustain. For more see his *Cement of the Universe*, p.17.

[279] Ibid., pp.216-217. Note that in response to the Humean objection to this, (that we never perceive such
necessary connection), Mackie follows Kneale and claims that the Humean project is based on a mistaken
doctrine of perception. What is needed is Realism in regard to certain features and processes that are
hidden from our view.

[280] Ibid., p.229.

continuity of processes, as well as by the persistence of objects.[281] So, for Mackie persistence will fill the gap that Hume thinks cannot be filled.

We may suggest, then, that basic laws of working are, in part, forms of persistence. ... I argued for extensions of the concept of causing to include both the persistence of objects and the persistence of self-maintaining processes, saying that in both of these we could regard an earlier phase as a cause and a later phase as an effect. ... What is called a causal mechanism is a process which underlies a regular sequence and each phase in which exhibits qualitative as well as spatio-temporal continuity.[282]

I would criticise Mackie's revised Humean theory on two points. First, the account ultimately relies on the argument that laws of nature can sustain the relevant counterfactuals. I will have some criticisms of such counterfactual theories of causation in a later section of this chapter (§4.2) There I will show how counterfactual causal perdurantism also fails to demarcate genuine from pseudo identities within homogeneous objects. Secondly, Mackie's account of causation refers to the persistence of objects and the persistence of self-maintaining processes. In doing so, the account cannot be applied to causal perdurantism. Such an account that would see identity through time as a matter of causal relations between temporal parts – where that causation is itself analysed in terms of persistence, will be circular. We should conclude that a modified Humeanism, such as that put forward by Mackie, fails on our second criterion – D2.

In conclusion, we have seen that because it does not provide a sufficient causal condition, and therefore fails to exclude pseudo identities, Humean perdurantism falls foul of RDA, that is, it fails D1. Resemblance conditions cannot do the requisite

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[281] Ibid., p.228. This point is extremely important to our purposes. Nevertheless discussion of it will have to await chapter five. There I will examine Mackie's influence on the work of Douglas Ehring and the role of persistence in characterising causation.

[282] Ibid., p.221-222.

work here. Similarly, attempts to build that sufficiency into Humeanism by recourse to persistence will fail on D2. I will now turn to another theory of causation that is also nomic in nature, in that it analyses causation in terms of laws, but differs in that it casts those laws as probabilistic in nature.

Probabilistic laws of nature

According to the probabilistic theory of causation, causes increase the probability of their effects. On one version of the theory, c causes e if and only if two conditions are met. First, the cause must raise the probability of the effect. That is, $Pr\ (e/c) > Pr\ (e)$. Second, there must be no event prior to c which 'screens off' c from e, where c is screened off from e just in case there is an event d, earlier that c such that $Pr\ (e/c.\ d) = Pr\ (e/d)$. Patrick Suppes, a proponent of this theory of causation claims to be a 'semi-Bayesian' about probabilities.[283] However, his thinking about probabilities has its origins in the work of Hans Reichenbach, whereby these probabilities are taken to be frequencies.[284]

Probabilistic causal perdurantism will dictate that two stages or temporal parts of an object are parts of the one persisting object only if they stand in the appropriate probabilistic relation. That relation is chance raising, such that the existence of a previous temporal part of the object raises the probability of the existence of a subsequent temporal part of that same object. So, in terms of causation between temporal parts we can say of two successive stages of an object, a_1 at t_1 and a_2 at t_2, that $Pr\ (a_2\ t_2/a_1\ t_1) > Pr\ (a_2\ t_2)$, where a_1 is not screened off from a_2. We should also note

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[283] Suppes, *A Probabilistic Theory of Causality*.

[284] Hans Reichenbach, *The Direction of Time*, 2nd ed., (Berkeley: University of California Press, 1991).

that, on this theory, chance raising is a necessary, but not sufficient condition for causation.

Probabilistic causal perdurantism also cannot avoid RDA. Suppose that the probability that a certain portion of the sphere a will occupy the SE quadrant at time t_2, given that it occupied the NW quadrant at t_1 is greater than the probability that a will occupy the SE quadrant at t_2. Or in other words, if the portion was in a certain position earlier, it is more likely to have rotated than to have stayed in stasis.

The problem with probabilistic causal perdurantism is directly analogous with the Humean case. This is because, according to this theory probabilities are taken to be Humean frequencies. The upshot is that there is chance raising within the sphere that does not entail identities. It is true that genuine identities are chance raising in RDA contexts. For example, take the case of rotation, where two temporal parts of the sphere are said to be causal connected. Because the sphere has rotated, the probability that a certain portion of the sphere a will occupy the SE quadrant at time t_2, given that it occupied the NW quadrant at t_1 is greater than the probability that a will occupy the SE quadrant at t_2.[285] Or,

$Pr\ (a_{SE}\ t_2/a_{NW}\ t_1) = 0.5$, and

$Pr\ (a_{SE}\ t_2) = 0.2$.

The probability of the genuine identity in the rotation case is higher than that which expresses the non-actual case where the sphere remains stationary. However, we can also see that chance raising will occur in pseudo identity cases. For example, the probability that a certain portion of the sphere a will occupy the SE quadrant at time t_2,

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[285] But of course this depends on at what rate the sphere is rotating, and on how long this has been true.

given that a *distinct* portion, *b* occupied the *NW* quadrant at t_1 will be greater than the

probability that *a* will occupy the *SE* quadrant at t_2.[286] Or,

$Pr (a_{SE} t_2/b_{NW} t_1) = 0.5$, and

$Pr (a_{SE} t_2) = 0.2$.

That is, the fact that one portion is at a certain time and place has implications for other

portions of the sphere. In fact, each portion bears chance-raising relations to all other

portions.

How can we even know what the relevant probabilities are in this case? We

could say, for instance that *if the sphere is rotating* the probability that a certain portion

of the sphere *a* will occupy the *SE* quadrant at time t_2, given that it occupied the *NW*

quadrant at t_1 is one. This is true *provided that* the sphere is rotating with a certain

velocity. But we cannot assume this state of motion – for that would be to beg the

question at hand. Suppose we specify that the probabilities cannot be either one or zero.

This might help us to resist the temptation to make assumptions about the state of

motion of the sphere.

Suppose there is a certain probability that the sphere will rotate, given its

state at t_1 and a certain probability that the sphere will not rotate, given its state at the

same time, t_1. Presumably, either these conditional probabilities will be free from

references to cross-temporal identities or they will refer to cross-temporal identities. If

they do *not* refer to cross-temporal identities, no determination can be made as to

whether or not the sphere is rotating. An example of these sorts of conditional

probabilities might be probability statements that claim there is a certain probability that

if the sphere displays certain properties at t_1 it will display certain properties at t_2.

However, the properties the sphere displays at t_2 will be the same whether the sphere is

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[286] Again, this depends on how fast it is moving and for how long.

rotating or in stasis, given that the sphere is homogeneous. On the other hand, if the conditional probabilities *do* refer to cross-temporal identities, they will still not be able to determine the fact of rotation. Suppose that the probability that the portion a will occupy the *SW* quadrant at t_2 given that it occupies the *NW* quadrant at t_1 is greater than the probability that a will occupy the *SW* quadrant at t_2. Assume also that no earlier circumstance screens off this probabilistic relation and that none of these probabilities are (0) or (1). We will not be able to infer from these probabilities alone, whether the sphere is rotating.

In fact, the only hope we have of using probabilities to differentiate between rotation and stasis is to first specify the persistence of certain portions of the sphere prior to assigning those probabilities. We must stipulate in our formulation of the conditional probability that captures rotation, that the portion, a, at t_1 is *identical* to the portion, a, at t_2. That is, we must stipulate rotation itself and therefore facts of identity. Therefore, we can see that the mistake has recurred in the probabilistic case. States of motion have been presumed.

We can conclude that probabilistic causal perdurantism fails RDA. This is because there are chance-raising relations within the sphere that do not entail identities. The only way to exclude these pseudo identities is either to specify facts of motion about the homogeneous object at the outset, or to assume that certain portions of the sphere have persisted through time. Given the earlier discussion of motion, (§3.2) and the conclusion that states of motion must also assume the persistence of objects, or their parts, we can conclude that probabilistic perdurantism fails both of our criteria D1 and D2. It is not difficult to see the reason for this failure. The probabilistic theory of causation as outlined above is Humean in nature. The theory is Humean in that it is

based on genuinely local Humean properties. This is just not enough to distinguish

stasis from rotation.[287]

Propensities and single case objective chance

There is another kind of probabilistic theory of causation, advanced by D.H Mellor.[288]

Mellor is not a perdurantist in regards to the identity through time of objects, although

he is one in the case of events. For Mellor, the difference between objects and events is

just that events have temporal parts and objects do not. As such, Mellor is an

endurantist. Nevertheless, the task here is to attempt to apply a range of theories of

causation to causal perdurantism. Whether or not a propensity theory of causation is

available to the causal perdurantist remains to be seen. Such a theory relies on the

notion of single case objective chances.[289] A central concept in this theory is the chance

that a fact's holding gives, or would give, to another fact. So the propensity theory is

concerned with chance raising, as causes are said to raise the chance of their effects, but

it is rooted in the idea of propensities. It is argued that the evidential, explanatory and

means-end connotations of causation entail that causes raise the chances of effects.[290]

The relata of causation are said to be both facts and particulars. On this view facts are

actual states of affairs, which correlate with whatever can be expressed by true

sentences. Causes and effects can also be particulars, namely, things and events. In fact,

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[287] This argument, of course, rests on the Humean nature of the chances implicated in the probabilistic theory of causation.

[288] D.H Mellor, *The Facts of Causation*, (London: Routledge, 1995).

[289] See Armstrong's *What is a Law of Nature?* for a good discussion of Mellor on objective chances.

[290] Mellor, *Facts of Causation*, pp.51-58.

it turns out that on this view, the particulars involved in causation inherit the causal link between the corresponding existential facts corresponding to those particulars.[291]

Chances here are understood as objective single case chances that are measured by the probability calculus.[292] These chances are said to rest on dispositional propensities manifested by objects. Chances are also contingent on this view, and this means that chances are properties of other facts, (facts without which they would not exist). We can represent such a chance as '$ch_Q(E)$', where Q is the fact or conjunctive fact of which the chance is a property. So, the chance of the effect E is a property, not of the effect, but of another fact, namely the cause C (or the conjunction of C and S, where S is the circumstances in which C causes E). On this view, every cause and effect has such a chance, (the chance the cause gives the effect, $ch_C(E)$. Similarly, every effect has a chance of existing in the circumstances without C, even if that chance is zero. This chance is expressed by $ch_{\neg C}(E)$.

The propensity theory attempts to capture the chance that a cause C gives its effect E in the circumstances, S. The idea here is that the chance that a cause gives to its effect must be greater than the chance that the cause's non-occurrence gives to that effect. Or, $ch_C(E) > ch_{\neg C}(E)$. The circumstances S, in which C causes E are taken to be

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[291] In his *Facts of Causation*, p.139 Mellor gives his analysis in terms of causal facta, which resemble Armstrong's states of affairs. Mellor ultimately concludes that "Discovering what makes one fact cause another will thus show us what makes one particular cause another. ... It looks as if all singular causation either is, or reduces to causation between facts." I argue elsewhere in my 'Mellor, Facts and Causation: Translation or Reduction?' (unpublished manuscript), that this reductive program cannot succeed.

[292] The idea of probability raising as single case objective chance can be contrasted with alternative interpretations of the probability calculus. These alternatives include those based on: (1) credence conditions; (2) classical ratios of possibilities; and (3) frequencies. Single case objective chances give an individual outcome an intrinsic probability rather than a frequency of a certain class of events and consequential logical probabilifications. The theory specifies that the probability assigned should be some genuinely intrinsic feature of each individual occurrence of the antecedent conditions occurring in a statistical law.

those circumstances which are relevant to the chance that C gives E. These circumstances S then give E a chance of obtaining in the absence of C.[293]

The propensity theory makes use of Lewis's semantics for counterfactual conditions.[294] That is, it employs closest world conditionals to analyse the chance that a cause gives its effect. In cases of deterministic causation, the chance that the cause C gives its effect E in the circumstances is one, or $ch_C(E) = 1$. In these deterministic cases the causal conditional, 'if C then E' holds. For example, if a cause C is sufficient in the circumstances for its effect, then the chance that C gives E in the circumstances is given by the chance of E in the closest world in which C occurs, which is one. A cause C is necessary for an effect E, only if $ch_{\neg C}(E) = 0$. That is, if a cause C is necessary in the circumstances for its effect, then the chance that C gives E in the circumstances is given by the chance of E in the closest world in which C does not occur, which is zero.

The account of indeterministic causation is also given in terms of of objective chances.[295] We can use the connective '$\Rightarrow$' to express E's chances in the closest world in which, C either does or does not obtain.[296] These are the possible worlds most like our own in which 'C' is true and where '$\neg C$' is true, respectively. E's chances are in fact, the chances p and $p\,'$, such that $C \Rightarrow ch(E) = p$ and $\neg C \Rightarrow ch(E) = p\,'$ are true.[297] That is, they are E's chances in the circumstances with and without C. The chance that

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[293] This analysis leads Mellor to his account of a necessary cause, namely one whose circumstances give its effect a zero chance of occurring in its absence.

[294] See Lewis's *Philosophical Papers: vol II,* for a fuller account of these conditions. Note though, that in Mellor's case the consequent of these conditionals is the *chance* of an effect E, rather than simply E.

[295] To complicate matters, facts that have chances can have more than one chance, usually by having them at different times. Note that this theory is also law based. Ultimately, causation entails the laws of nature that determine the kinds of facts our world contains.

[296] As Mellor does in his *Facts of Causation*, p.27.

C gives E and the chance that $\neg C$ gives E, are E's chances in the closest possible worlds where 'C' and '$\neg C$' are respectively true.[298]

How can we apply a propensity theory of causation to causal perdurantism? We might formulate this account as follows. Two temporal parts a and b are genidentical or are parts of a persisting whole if and only if they are causally connected - where being causally connected is taken to mean that $ch_C(E) > ch_{\neg C}(E)$, or the chance that C gives E, is greater than the chance that $\neg C$ gives E. Recall that we are asked to evaluate these chances in terms of closest world conditionals. So the temporal parts a and b will be causally connected only if, $C \Rightarrow ch(E) = p > \neg C \Rightarrow ch(E) = p'$, or the chance of E in the closest C-world is greater than the chance of E in the closest $\neg C$-world.

For example, two temporal parts of this page a and b are causally connected only if the chance that b occurs in the closest a-world is greater than the chance of b in the closest $\neg a$ world. But what does this 'closest $\neg a$ world' come out as on this picture? It is a world in which the earlier temporal part of the page a, does not exist. What is the chance that the later temporal part of the page b, will exist in such a world? That depends. If causal perdurantism is true, then this chance will be zero. For, according to the perdurantist, the earlier temporal part of the page is a necessary condition of the existence of the later stages of the page.

Can a propensity theory make the difference between rotation and stasis in RDA contexts? The answer to this question will depend on two factors. Firstly, it will depend on whether or not we think the case of a homogeneous object in motion is

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[297] Note that p and p' are unlikely to take real values and should be given as intervals of numbers. I will follow Mellor and for simplicity's sake treat p and p' as though they were precise.

[298] Mellor, *Facts of Causation*, p.28.

deterministic. Secondly, it will depend on what we take the relevant circumstances S to be in RDA cases.

Assume for the moment that the sphere scenario *is* deterministic. Suppose that our cause C is the fact that a certain portion of the sphere a, occupied the *NW* quadrant at t_1. Our effect, E is the fact that the same portion of the sphere a occupies the *SE* quadrant at time t_2. What is the objective single case chance that a occupies the *SE* quadrant at time t_2, given that it occupied the *NW* quadrant at t_1? We can evaluate this in this way. We can say that the $ch_C(E)$ in the circumstances is just the chance that E has in a world where C occurs. This is the deterministic case. What is the chance that portion a is here, given it was there? It is only when we start to think about these chances that we realise the importance of the effect E. In this formulation, we have stipulated that E is the fact that the *same* portion of the sphere a occupies the *SE* quadrant at time t_2. Here we are assuming facts of identity about a, which will lead to circularity. What has happened here is that rotation has been built into the scenario in order that C can give E a certain chance.

Perhaps we can avoid this outcome by rephrasing our question like so. Suppose that our cause C is the fact that a certain portion of the sphere a, occupied the *NW* quadrant at t_1. Our effect, E is the fact that *some portion of the sphere or other* occupies the *SE* quadrant at time t_2. What is the objective single case chance that some portion or other occupies the *SE* quadrant at time t_2, given that a occupied the *NW* quadrant at t_1? Of course, the answer is one. Some portion or other must be there. But this does not help us to specify the fact of (non)rotation. If the theory does not invoke facts of identity, it cannot resolve RDA, but if it does do so it will become circular.

What about the circumstances S, in this case? S has been stipulated to be the circumstances that are relevant C causing E.[299] Exactly how we define these circumstances is a vexed question. It might be that the circumstances relevant to the chance that C gives E include: the circumstance that perdurantism is true, or perhaps the circumstance that the actual world does not admit of immaculate replacements.[300] If we specify the circumstances S in *this* manner, we can formulate causal perdurantism under a propensity theory of causation.[301] However, on this way of thinking the question of chance raising or lowering will always turn out to be - it depends. It depends, in fact, on whether or not the sphere is rotating, and if it is - how fast it is moving. If the sphere is rotating, (at a certain specified uniform rate) then the chance that C gives E is just the chance that the fact that a occupied the *NW* quadrant at t_1 gives the fact that a occupies the *SE* quadrant at time t_2 – and this will be a chance of one. The fact that a was there makes it certain that a is here, *given S*. Note that this only holds in certain circumstances, that is it is conditional on S, which we have said includes the fact that the sphere is rotating and the fact that it has a certain velocity. On such a deterministic view, C is also necessary for E, in that $ch_{\neg C}(E) = 0$. Now we consider the closest word in which C does not occur, (a world in which a does *not* occupy the *NW* quadrant at t_1). Given S, the fact that a does not occupy the *NW* quadrant at t_1 gives the fact that a occupies the *SE* quadrant at time t_2 a chance of zero. If a was not there, it will not be here. Again, S will need to be specified. S must only include those circumstances that

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[299] Ibid., pp.24-25.

[300] Here, we want the existence of the later temporal part b to not be prevented by any instantaneous annihilation, followed by the creation of a qualitatively identical, yet distinct temporal part c.

[301] Note that if we specify that the circumstances, S, include the circumstance in which perdurantism is false, the relevant chance raising will not be apparent.

are relevant to the chance that C gives E, and it seems that in RDA contexts, one of those circumstances must be the fact of (non)rotation.

But this surely begs the question at hand. Recall the challenge of RDA is to find some difference between the homogeneous object in motion and in stasis. Causal perdurantism is a solution according to which the causal relations between the temporal parts of the sphere will be different depending on the object's state of motion. But here we have had to include these states of motion in our characterisation of the circumstances S. As I pointed out in chapter three (§3.2), states of motion such as velocity inevitably rely on facts of identity. Therefore, this kind of account is again shown to be circular.

Here is a better way to point out the problem for propensity theory. Imagine a portion of the sphere, b. Suppose that our cause C is the fact that a distinct portion of the sphere a, occupied the *NW* quadrant at t_1. Our effect, E is the fact that b occupies the *SE* quadrant at time t_2. What is the objective single case chance that b occupies the *SE* quadrant at time t_2, given that a occupied the *NW* quadrant at t_1? Again, it depends. If the sphere is rotating at a certain rate, the chance might be one. If, however the sphere is stationery, the chance will be zero. I want to argue that if we specify S in a certain way, we will find that the fact that a occupied the *NW* quadrant at t_1, gives the fact that b occupies the *SE* quadrant at time t_2, a chance of one – namely if S includes the fact that the sphere is stationary through the interval t_1 to t_2. That is, the fact that one sphere portion is in a certain position at a certain time, might raise the chance that a *distinct* sphere portion is in a certain position at a later time.[302] Here we have a chance-raising

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[302] In fact, unless the sphere portions are migrating, that is unless they have different directions and velocities relative to one another (and note that if this is the case, we have in a real sense lost any case for saying that the sphere is an individual object) then facts about a's position seem to necessitate facts about the position of b and all other sphere-portions.

relation between distinct sphere portions. Therefore, this kind of propensity account cannot demarcate genuine from pseudo-identities.

We can conclude that propensity-based causal perdurantism fails both criteria D1 and D2. This is because there are chance raising relations within the sphere that do not entail identities. The only way to exclude these pseudo identities is to specify; either facts of motion (which is tantamount to assuming that certain portions of the sphere have persisted through time), or facts of identity about parts of the homogeneous object from the outset.

Neo-Humean causation

As was mentioned in the previous chapter (§3.3), Armstrong invokes a rotating disc argument as a motivation for the causal account of identity. The claim is that immanent causal relations within the sphere will fix the facts of motion for us. According to Armstrong, causation will serve to mark off genuine identities from pseudo ones. However, in order to explain this view we must distinguish between two questions. First, are laws of nature regularities? Second, are causes instantiations of laws of nature.

In relation to the first question, Armstrong denies that laws of nature are regularities. We can characterise Armstrong's theory of laws as follows.[303] Hume is correct in his claim that laws are involved in causation but is incorrect in saying that regularities are such that they can adequately characterise laws of nature. It is true that causal connection is nothing more than nomic connection, but it is not the case that this fact entails that nomic connection is nothing over and above regular succession.[304] The Humean confuses laws with regularities because she fails to distinguish between

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[303] Armstrong, *World of States of Affairs*, chapter 14.

epiphenomenal and genuine processes, and therefore misses the lesson of singularist theories of causation.

In relation to the second question, Armstrong argues that conceptually, causes are *not* instantiations of laws of nature, but ontologically they *are* instantiations of laws of nature. Causation, is in fact, an intrinsic relation dependent on something belonging to the causal process itself. As such, causation is conceptually primitive. Our concept of causation turns out to be the ancestral of the ontological relation of causation. This singular causation is not ontologically primitive.[305] Ontologically speaking, causation is to be identified with the instantiation of certain laws, where those laws are not seen as Humean regularities. Rather, laws are properly taken as strong laws, where a nomic connection is manifested in each individual instantiation of the law. These laws are the truthmakers for causal truths. However, these truthmakers are not constituted by regularities, but rather by certain necessitation relations between universals. Causation then is a *direct* relation between token states of affairs, and the truthmaker of a singular causal statement is the obtaining of a certain strong law. These strong laws express the necessary relations that hold between universals. In short, when seen as a direct relation causation is intransitive and ontological in nature. When we

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[304] Another advocate of this account is Swoyer. See his 'Causation and Identity', p.605.

[305] A theory of causation based on an intrinsic, singularist feature has a better chance of avoiding RDA. We need to discover the ontological nature of the causal relation in order to fix certain facts of motion. We want to know what makes it true that the sphere is in motion, rather than not, and in this regard we need truthmakers for such a fact. It seems that those truthmakers must lie in something intrinsic to the sphere itself. That is not to say that conceptual analyses will not facilitate this discovery. It is our means to uncovering the singularist feature unique to the causal relation.

speak of indirect causation however, we are referring to the concept of causation, which

is intransitive and ancestral.[306]

All that remains is to apply Armstrong's account of ontological causation to

the issue at hand. We want the necessitation relation between universals instantiated by

identical sphere stages to differ in some respect from the necessitation relation between

universals instantiated in the *pseudo-identical* case. If this can be achieved, we will be

able to tell the difference between rotation and stasis and avoid RDA as promised.

Recall that the problem for the Humean was to differentiate between

genuine identities within the sphere and pseudo-identities, expressed by

(i)R $\{(Fa\ t_1) \supset (Fa\ t_2)\}$, and

(ii) R $\{(Fa\ t_1) \supset (Gb\ t_2)\}$.

Can a theory that sees causation as a necessitation relations between universals provide

for some difference between (i) and (ii) without stipulating either object identities or

facts of motion? Armstrong will maintain that in the genuine identity case, (i) we have a

genuine necessitation relation between the universals instantiated, whereas in the

pseudo-case (ii) we do not. To elaborate, imagine the sphere has rotated. There will be

genuine identities here, which amount to singular necessitation relations between

universals, something like

(iii) $N\{(Fa\ t_1),(Ga\ t_2)\}$,

where 'N' denotes a necessitation relation, and 'F' and 'G' denote certain complex, or

structural universals instantiated by a certain portion of the sphere, say, having a certain

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[306] For more on the relation between conceptual and ontological causation see Armstrong's 'The Open Door: Conceptual versus Singularist Theories of Causation, in Howard Sankey (ed.), *Causation and Laws of Nature*, (Dordrecht: Klewer, 1999), pp.175-186, and his *World of States of Affairs*, chapter 14.

colour, shape, relative spatiotemporal position, momentum, velocity and so on.[307] The

idea is, of course that the pseudo-identity statement,

(iv) $\{(Fa\ t_1),(Gb\ t_2)\}$

is pseudo in virtue of the fact that it lacks the appropriate necessitation relation, and not

because it refers to distinct particulars. The reason there is no necessitation relation in

(iv) is that the causation involved here is indirect, perhaps as the result of the action of a

common cause.

I have two criticisms to make of this strategy. First, I want to maintain that

there necessitation relations do also obtain in the pseudo case (iv). Granted, they will

not be ones that involve identities, but they will be there all the same. The fact that a

certain portion instantiates a certain property, say a certain velocity, will impose

necessities on distinct portions of the sphere, given that these portions are parts of a

unified object. Therefore, I want to argue that Armstrong cannot maintain that the

holding of a necessitation relation is what will mark the difference between cases of

genuine and pseudo-identity. Accordingly, I want to maintain that nomic causal

perdurantism, which sees causation as a matter of necessitation relations between

universals, fails on criterion D1 – it fails to demarcate genuine from pseudo identities

and therefore falls prey to RDA.

Secondly, taking what I have said to heart, we find that the formalisations of

the genuine and pseudo-identities, for a rotating sphere come out as,

(iii) $N\{(Fa\ t_1),(Ga\ t_2)\}$, and

(v) $N\{(Fa\ t_1),(Gb\ t_2)\}$

This formalisation gets us nowhere in avoiding the problem of circularity which we saw

beset the Humean. The *same* sphere portion a has been re-identified in (iii). We might

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[307] Here I adopt Armstrong's own style of notation in his *World of Sates of Affairs*, chapter 15.

perhaps think then, that all talk of sphere portions is best left out of our formalisation. This leads us to,

(vi) $N\{(F\ t_1),(G\ t_2)\}$,

(vii) $N\{(F\ t_1),(G\ t_2)\}$

where we are left with necessitation relations between universals instantiated (by 'something') at certain times. But (vi) and vii) are not well-formed formulae. In any case, in the formulae, (vi), (vii) which are purged of reference to entities, the difference between the genuine and pseudo identities is even harder to discover. The formalisations are indistinguishable. What then, will mark the difference between a case of genuine persistence within the sphere, and a pseudo-identity? Here are a few attempts to spell out what that feature might be.

First, we might think that singularism, or intrinsicality might mark the difference. That is, it might be that the causation in the pseudo case is in some way *not* intrinsic. This will not work, however. After all we must remember that both cases are causal, and therefore are both singularist and intrinsic. The difference between them lies in the fact that one expresses an identity and the other does not. Second, we might think that the difference lies in the *relata* of the necessitation relation, that is, in some difference between the universals expressed by (vi) and (vii). But I do not think this will work. The 'F' appearing in the genuine case is the same universal that appears in the pseudo case, (with the same holding for the 'G's'). Similarly, the difference here will not lie in the *strength* of the necessitation relations involved in (vi) and (vii). A better candidate might be some difference in the *truthmakers* of the necessitation relations involved in (vi) and (vii). Recall that the truthmaker of the necessitation relation will be the obtaining of certain laws (in this case physical laws) governing the motion (or stasis) of the sphere. These laws will include: the law of conservation of angular

momentum given initial conditions, together with certain structural forces, such as rigid body force. But again, this will not 'make the difference'. The very same laws will be involved in both cases. If the sphere is rotating the same laws will apply to a portion that has persisted throughout time, (and changed position through rotation), and two *distinct* portions of the sphere, that have different positions, and have rotated. To elaborate, (vii) is supposed to express a pseudo-identity, and this was quite clear when it was presented in its earlier guise as (v), that is, before it was purged of sphere portion-particulars (such as a and b). However, just the same physical laws given initial conditions, are manifest in (vii) as in (vi). Therefore, invoking these laws will not ground the difference between the two cases. Could it be that the difference is in the initial conditions? No, because since both (vi) and (vii) are meant to express rotation, the initial conditions are isomorphic.

To put the argument a different way, take for example a law that governs a rotating sphere and expresses a genuine identity. It will involve a portion of the rotating sphere a at a certain place, p_1 and at a certain time, t_1, which stands in a necessary relation to *the very same* portion of the sphere a at a different place, p_2 and at a later time, t_2. Something like,

(viiii) $N\{(a\,p_1t_1),(a\,p_2t_2)\}$.

Now take another a law that governs a stationary sphere and expresses a pseudo-identity. Imagine a portion of the stationary sphere, a, at a certain place, p_1 and at a certain time, t_1, which stands in a necessary relation to a *distinct* portion of the same stationary sphere, b, at a different place, p_2 and at a later time, t_2. Something like,

(ix) $N\{(a\,p_1t_1),(b\,p_2t_2)\}$.

As I have said, the best candidates so far, for grounding the difference between (xiii) and (ix) are the truthmakers of the necessitation relation in each case, that

is, in the laws that govern the action of the sphere. However, these laws will only appear

to differ if we *at the outset* stipulate facts of identity. (Which is exactly what has been

done in the above formulae). The sphere portions have reappeared, the states of motion

have been assumed from outset, and the status of the identities as pseudo or genuine has

been stipulated, rather than shown.

In this section I have pointed out the shortcomings of law-based theories of

causation when it comes to RDA. I do not think that these shortcomings are surprising. I

suspect that the supervenience base of all laws of nature (no matter how conceived)

includes certain facts of identity about persisting particulars. I agree that:

... appealing to laws to decide identity questions will in some cases at least misrepresent the relation
between the laws and what makes the laws true. Facts of identity will in some cases help determine which
of a set of possible laws is actual. The supervenience base of laws includes facts of identity, and, hence,
the neo-Humean causal theory of identity, understood as a supervenience thesis, cannot be accepted.[308]

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[308] Ehring, 'Motion, Causation and the Causal Theory of Identity', p.186. Note that Ehring's argument to
this conclusion differs from mine. His argument is as follows. Suppose we do not know whether the
lawlike statement L_1 or the lawlike statement L_2 is true of a certain sequence of object stages S.
Presumably, it is either the case that L_1 and L_2 are each about S, or it is the case that there is no such
entailment. Imagine firstly that neither of these laws do entail any facts of identity. Such a law might look
like this - L_1: if an object has a property P at t_1, then there will exist an object at t_2 which has P. Suppose
also that sequence S begins with a stage that has P and this stage is followed by another stage which also
has P. We now find that L_1 is compatible with the conclusion that either (a) the two object-stages of S are
genidentical *and* b) the two object-stages of S are not genidentical. So, it seems that if neither of the laws
in question contain reference to some object identity, reference to them will not help resolve the
genidentity of the stages of S. Now, suppose instead that both L_1 and L_2 are neutral with respect to
identity facts regarding S. Such laws might take the form - L_1: if an object x has property P at t_1, then x
will have P at t_2, and - L_2: if an object x has property P at t_1, x will go out of existence and be replaced
with a qualitatively similar object y at t_2 which also has property P. Suppose now that the first stage of S
consists in an object stage with property P and the next stage consists of a qualitatively similar stage with
P. We can now ask; which is true of S? L_1 or L_2? The fact is that we cannot resolve this question, because
we cannot know whether or not the object has been annihilated, without further information, specifically
without the identity facts for S. This means that we cannot know which law holds of S *until* we know if
the first and second stages are stages of the same object.

It is for this reason that all nomic causal accounts of identity fail to solve rotating disc arguments. As we have seen in this last case, the only way the nomic account can differentiate between genuine and pseudo identities is to reintroduce facts of identity, and thereby fall into circularity. Therefore causal perdurantism, where that causation is understood as law-based, will always be circular if it is to address RDA.

4.2 Counterfactuals and rotating disc arguments

In this section, I want to turn to the counterfactual theory of causation, as presented by Lewis.[309] I will begin by outlining the theory, and then assess how it may be used within causal perdurantism. The theory's success in avoiding RDA will be discussed, as will Lewis' amendments to his theory, which are intended to encompass cases of indeterministic causation. By way of introduction, we can see that Lewis takes to heart Hume's second definition of causation, where causation is defined as, "if the first object had not been, the second had never existed."[310] What we must to do, according to Lewis, is see causation as involving counterfactuals, but also see those counterfactuals correctly, that is, as statements about possible alternatives to the actual situation, vaguely specified, in which the actual laws of nature may or may not remain intact.

[309] Lewis credits Ardon Lyon with originating the view in his 'Causality', *British Journal for the Philosophy of Science*, 18 (1967) pp.1-20. Other expressions of the theory can be found in: Stalnaker's 'A Theory of Conditionals', in Nichoas Rescher (ed), *Studies in Logical Theory* (Oxford: Blackwell, 1968); and Lewis's *Counterfactuals* (Oxford: Blackwell, 1973).

[310] Hume, *Enquiry*, sect VII. Note that Hume's first definition of causation, (whereby causation involves regularity of succession), is *not* endorsed by Lewis. Lewis (rejects the regularity analysis because of what he sees as its failure to distinguish 'regularities that count' from accidental generalisations, and secondly because of his belief that regularity analyses tend to confuse causation itself with other causal relations. For details see Lewis's 'Causation', *Journal of Philosophy* 70, pp.556-567, reprinted with Postscripts in *Philosophical Papers vol II*. (New York: Oxford University Press, 1986), p.160.

According to the counterfactual theory of causation, direct causation is best characterised by the notion that an effect is counterfactually dependent on its immediate cause. What makes c causes e true is the conjunction of the fact that both c and e occur, and that a certain counterfactual statement holds, something like, 'if c had not occurred, e would not have occurred'. In the case of indirect causation, events that are indirectly causally connected will always be connected by a chain of events such that each member of the chain is counterfactually dependent upon its immediate predecessor.[311] Lewis' theory rests on the notion of counterfactual dependence between events. We can summarise Lewis' theory as the view that one event is a cause of another if and only if there exists a causal chain leading from the first to the second.[312] Lewis adds the requirement that distinctness of events is required in genuine cases of causal dependence. Two events are distinct if they have nothing in common - that is if they are not identical, neither is a proper part of the other, and neither shares a common part.[313]

As I said above, for Lewis $A \rightarrow C$ is non-vacuously true if and only if C holds at all the 'closest A-worlds'. But how do we rank these possible worlds in terms of 'closeness'? Lewis takes the relation of comparative-over-all-similarity among possible worlds as primitive. One world is closer to actuality than another if the first resembles our world more than the second, taking into account the respects of similarity and

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[311] Lewis also maintains that the counterfactual conditional implies the material conditional. So, if a proposition, A, is true, then the actual world is what we would call 'the closest A-world'. Put more formally, we can say that according to Lewis, $A \rightarrow C$ is true iff C is true. Therefore, $A \rightarrow C$ implies $A \supset C$, and A and C jointly imply $A \rightarrow C$.

[312] Here I am omitting discussion of Lewis' notion of 'quasi-dependence', the introduction of which is said to dispel the problem of late pre-emption for the counterfactualist. (Details can be found in his *Philosophical Papers Volume II*, p.206-207.

[313] *Philosophical Papers Volume II*, pp.172-173.

difference and balancing them out. So, we can say truly that a world, say, world$_1$ is 'closer' to the actual world, world$_w$, than another, world$_2$.[314]

In his (1973)[315] Lewis admits the limitations of his theory. The fourth confessed limitation is that his original account 'cannot yet cope with all the varieties of causation under indeterminism'.[316] However, the challenge of indeterministic causation is taken up as Lewis extends his theory to range over the causation of events for which the prior conditions are *not* lawfully sufficient. So called 'chancy' causation has already arisen in the discussion of Lewis's account as presented above. It occurs in cases where *c* occurs and *e* has some chance of occurring - *e* does occur; but if *c* had *not* occurred, then *e* would have had no chance of occurring and so would not have occurred. On Lewis' original analysis this means that *e* depends causally on *c*, and *c* is a cause of *e*.[317]

However, there is another sense of chance, not covered by this analysis. Suppose that *c* occurs, and *e* has some chance ch^2 of occurring. As it happens, *e* does actually occur. However, if *c* had *not* occurred, *e* would still have some chance ch^1 of occurring, but only a slight chance since ch^1 would have been less than ch^2. The problem here is that it is *not* true that without the cause, the effect would not have

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[314] Note that Lewis places two formal constraints of the relation of comparative similarity ('Causation', p.164). First, there should be a weak ordering of worlds - that is, one in which ties, or dead heats are allowed. Second, the actual world should be closest to actuality, for of course it resembles itself more than anything else does. In addition, there is no constraint such that for any set *A* of worlds there is a *unique* closest *A*-world, or even a set of *A*-worlds tied for closest. Nothing precludes the existence of an infinite sequence of closer and closer worlds but no closest. I do not pretend that the relation of over-all similarity is completely transparent. However, this does not bother Lewis who seems content to trade similarities of particular matters of fact against similarities of law.

[315] Lewis, 'Causation'.

[316] Ibid., pp.162-3. The other three confessed limitations are (1) that his discussion is confined to causation among events, (2) that his analysis only applies to causation in particular cases, and (3) that although we speak of 'the cause' as though there were no others, Lewis prefers to speak of 'a cause'.

[317] Lewis 'Postscripts to 'Causation'', p.175.

occurred. All we can say about this case is that without the cause, the effect would have been *less probable* than it actually was. Nevertheless, Lewis maintains that even in this case we can still maintain that *e* depends causally on *c*, and that *c* is a cause of *e*.[318]

Lewis adds several clarifications concerning the concept of 'chance',[319] and points out that his analysis of probabilistic counterfactuals differs from those presented by others.[320] Ultimately, Leiws's analysis of chance applies only to causation in the single case, that is, causation of one particular event by another event. This means that the probabilities involved in indeterministic causation are single case chances rather than finite or limiting frequencies.[321] Lewis's analysis is given in terms of counterfactual conditionals about probability. However, it is not given in terms of conditional probabilities. Lewis argues that if we try to use an inequality of conditional probabilities to express the fact that event *c* raises the probability of event *e*, we face a serious problem. That inequality may hold, *not* because *c* causes *e*, but because *c* and *e* are *joint effects* of common cause. Conditional probabilities are properly understood as quotients. However, if the denominator is zero, these probabilities will go undefined. If the probability that *c* occurs (given background conditions) is one, what will we say?

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[318] Ibid., p.176.

[319] Ibid., pp.176-177. These clarifications include: (1) Chances are time-dependent. The actual chance ch^2 of *e*, is the chance it has at the time immediately after *c*; (2) Lewis does not assume that there is some ch^1 (the chance of *e* if *c* had not occurred). 'Some chance ch^1' is a quantifier whose scope is limited to the consequent of the conditional; (3) 'Much less chance' is taken to mean 'less by a large factor', rather than 'less by a large difference'; (4) A chance event may be caused, but we should not say that it is caused to happen rather than not. Contrastive causal statements are different in kind to non-contrastive ones.

[320] Namely, it differs from those presented by Suppes in his *A Probabilistic Theory of Causality*, and that of Cartwright in her 'Causal laws and Effective Strategies'. Lewis (rather reluctantly) claims an affinity with the analysis of chances given by Mellor in his 'Fixed Past, Unfixed Future', in Barry Taylor (ed.), *Contributions to Philosophy: Michael Dummett* (The Hague: Nijhoff, 1986).

[321] Lewis, Postscripts to 'Causation'', pp.177-178. (See my discussion of propensity interpretations of probability in (§4.1) above).

Again, what if c has been predetermined through all of past time, in that its probability has always been one. This means that there is never a non-zero chance of c failing to occur. How can we apply the probabilistic analysis to the deterministic extremes? Lewis concludes that we should not accept an analysis of causation that works only under determinism *or* indeterminism. He criticises competing probabilistic analyses of single-case causation that use conditional probabilities, on the grounds that they are not neutral in this regard, but are tailored to suit deterministic scenarios. His analysis, on the other hand, is claimed to suit both deterministic and indeterministic causation.[322] In addition, it is crucial that a similarity relation, which is not conducive to backtracking governs the counterfactual which characterises causal dependence.[323] The account of probabilistic causation that emerges is that

... if distinct events c and e both occur, and if the actual chance of e (at a time t immediately after c) is sufficiently greater than the counterfactual chance of e without c, that implies outright that c is a cause of e.[324]

Lewis claims that his theory of causation has several advantages over its rivals. For example, it succeeds in distinguishing genuine causes from; effects, epiphenomena and pre-empted potential causes.[325] This sounds promising. To date, each theory of causation surveyed has resulted in the conflation of pseudo and genuine identities. Perhaps counterfactual causation can do the requisite work.

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[322] Ibid., pp.178-179.

[323] See his 'Counterfactual Dependence and Time's Arrow', *Nous* 13 (1979) pp.455-76, reprinted in *Philosophical Papers Volume II*, (New York: Oxford University Press) for a good discussion of backtracking counterfactuals.

[324] Lewis, Postscripts to 'Causation'', p.180.

[325] Lewis, 'Causation', p.161.

Counterfactual causal perdurantism will dictate that the persistence of an object relies on the fact that if a previous temporal part of the object had not existed, a subsequent temporal part of the object would not have existed. Persistence is seen as a matter of causal relations between parts, and those causal relations are said to be appropriately characterised by counterfactual statements (where a closest possible world analysis of counterfactuals is also given).

Let portion, a, of our homogeneous sphere occupy the *SE* position, or quadrant of the sphere. We might also know that a certain relation of counterfactual dependence applies to portions like a. In order to secure the fact of rotation, we need to know that portion a, which is in the *SE* quadrant at t_2, is the *same portion* as portion a, which was in the *NW* quadrant at t_1. If the portions are identical, the sphere is rotating, if they are not, the sphere is stationary. Perhaps a state of rotation might be captured by the following counterfactual,

(C_1) If portion a had not occupied the *NW* quadrant at time t_1, portion a would not have occupied the *SE* quadrant at time t_2.

In other words, if we know where the portion, a, is, and where it has been, we will be able to determine the fact of the sphere's (non)rotation. However, there are several problems with this account.

First, in order to formulate a counterfactual such as C_1, it has been taken for granted that portion a, at t_1 is *the same as* portion a at t_2. However, this was the very issue under question. The facts of identity have been assumed, rather than shown to be the case. We might say at this point that counterfactuals are not enough, and matters of spatiotemporal and qualitative continuity must also be taken into account. It might be thought that *this* will specify the fact of rotation or stasis. But of course, such factors will not be of assistance. The sphere is, by definition, homogeneous such that its

portions are undifferentiated. Perhaps we might reformulate our counterfactual (C_1),

such that it contains no re-identification of the portion, a, like so

(C_2) If portion b had not occupied the *NW* quadrant at time t_1, portion a would not have

occupied the *SE* quadrant at time t_2.

But this will not help. To evaluate this counterfactual, we must go to the closest $\neg a$

world. Here, facts about 'a' have re-appeared, (namely that it does not exist at a world)

and our picture is no clearer.

Second, according to this sort of analysis, counterfactuals are to be analysed

in terms of closest possible worlds. Recall counterfactual (C_1).

(C_1) If portion a had not occupied the *NW* quadrant at time t_1, portion a would not have

occupied the *SE* quadrant at time t_2.

Assume that the counterfactual C_1 is true in our world (W). The closest possible world

(W^*), to the actual world, is one which differs from W only in that the position of a at

time t_1, (and therefore a at time t_2), is slightly different from that which obtains in the

actual world.[326] However, note that in W^*, the position of not only a at t_1 but also of all

other portions of the sphere will differ from those in the actual world. It is a case of

'change one, change them all'. All portions of the sphere are counterfactually dependent

on all other portions of the sphere. Furthermore, if counterfactual dependence is the

mark of causation and causation is implicated in persistence, then somehow all of the

sphere's portions turn out to be identical to each other.

I would conclude then, that counterfactual causal perdurantism also fails the

criterion D1, as it fails to exclude unwanted pseudo identities, and therefore cannot

resolve RDA. Therefore, the counterfactual causal account of identity suffers doubly.

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[326] In my view, other worlds, say W^{**} in which a at t_1 changes position, but all other portions do not, seems farther removed from W than W^*.

First, it cannot avoid RDA without presuming facts of identity and thereby becoming circular. Second, it cannot adequately demarcate genuine from pseudo identities. There are genuine problems involved in marrying a counterfactual theory of causation to causal perdurantism. It might be that we can only know what counterfactual relations hold between objects, if we have already decided upon the facts of identity of those objects. But this is not an acceptable outcome if we are attempting to use counterfactuals to give an account of persistence itself.

4.3 Physical processes and rotating disc arguments

This section will examine various physical theories of causation and their applicability to causal perdurantism. The section begins with an examination the transference theory, as presented by David Fair.[327] After a discussion of the theory, I will turn to an examination of several more sophisticated transference theories; namely, those found in the work of Salmon and Dowe. The question I am attempting to come to grips with here, is this - can causal perdurantism, grounded in a transference theory of causation, succeed in avoiding RDA? Turning then, to Fair's account of causation as grounded in the transference of energy and/or momentum.

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[327] I have chosen David Fair's theory, rather than that offered by Jerold Aronson because it is superior in several respects. Fair's account does not require the full transference of a quantity like that of Aronson. This partial transference gels better with our best science, as energy has a tendency to dissipate in interactions. Conservation is never complete, but only partial. In addition, Fair is clearer about what quantities are involved in transference. Problematic quantities, which figure in Aronson's account, (such as velocity and heat) are excluded, such that causation is limited to the transference of energy and/or momentum. For the alternative transference theory see Jerold Aronson's 'On the Grammar of Cause' *Synthese* 22 (1971) pp. 414-430 and 'The Legacy of Hume's Analysis of Causation', *Studies in the History and Philosophy of Science*, 2 (1971) pp.135- 156.

Transference theory

All transference theories of causation, including Fair's, function as accounts of *physical* causation. These accounts work from the premise that true causal statements have their truthmakers in some physical events or interactions.[328] For Fair, physics has already provided us with the correct analysis of the true nature of causation. Causation is equivalent to the transfer of energy and/or momentum and this fact is a contingent, *a posteriori* empirical discovery. Ultimately, it will be the task of a complete unified science to provide the details of every causal situation, and therefore the truthmakers of every true causal statement of the form '*C* causes *E*'. Fair calls for a reduction of the causal relata found in our folk language. We must redescribe these events, facts, properties and so on, in terms of the objects of physics. However, it is clear that Fair is not an eliminativist in regards to causal folk-language. Rather Fair asks that we recognise a new class of objects - what he calls '*A*' and '*B*' objects. '*A*-objects', are those underlying objects that are causes. '*B*-objects', are those underlying objects that are effects. Physical quantities for Fair, are those quantities, (namely energy and momentum), that underlie the properties identified as causes and effects in common, or folk-causal talk.

The relation between *A* and *B* objects is one of transfer of energy and/or momentum. This means that the key to a true ascription of causation is the identification of the same energy and/or momentum manifested in the effect as was manifested in the cause. This may sound like a tall order, after all how could we know whether a packet of energy, manifested by an alleged effect, is the *self-same* energy once manifested by the alleged cause? Fair maintains that this re-identification can be achieved by

specifying closed systems associated with the objects in question.[329] Energy and/or

momentum transfer occurs when there is a flow of energy from the *A*-object to the *B*-

object. Transference is given by the time rate of change of energy and/or momentum

across the spatial surface separating the two objects. Transference is defined in terms of

the time derivative of the energy or momentum actually transferred in a causal situation.

We can summarise Fair's account in this way:

A causes *B* iff there are physical redescriptions of *A* and *B* as some manifestation of energy or momentum
or [as referring to] objects manifesting these, that is transferred, at least in part, from the *A*-objects to the
B-objects.[330]

Transference theory is said to explain the fact that we agree about most cases of

causation. We have, Fair says, reliable ways to identify cases of causation - we appeal

to other features such as contiguity and regularity. We can do this even in cases where

we fail to recognise the transference-based nature of the causal relation. Transference

theory explains why these features are reliable indicators, and why we generally reach

consensus about what does, and does not count as a true causal statement.

Transference and immanent causation

Fair's causal theory suffers from several problems. Not the least of these is the charge

that transference cannot be utilised in the formulation of causal perdurantism. Recall

that on this account the persistence of objects consists in the holding of certain causal

relations between the temporal parts of that object. As we have seen, this causation must

be immanent or intra-substantial - it occurs internally within one persisting object. The

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[328] This is not to say that statements such as "the Wall Street crash of 1929 caused the Great Depression"
are not causal, but only that such statements are derivatively dependent, at bottom, on some physical
transference events.

[329] Note that a system is said to be 'closed' when no gross energy and/or momentum flows in or out of it.

objection is that transference theories exclude immanent causation by definition. For transference to occur, *two* objects must be involved in a causal interaction. Therefore, by definition transference-based causation must be transeunt or inter-substantial. This objection perhaps comes out more clearly in the context of Aronson's transference theory, according to which in a causal statement such as '*A* causes *B*', '*B*' designates an *unnatural* change in an object. An unnatural change is a change that results from interactions with other bodies. Natural changes, on the other hand, are internal to an object and come about according to the natural course of events. Such 'natural' internal changes do not qualify as causal.[331] It is not difficult to see why internal or immanent causation is ruled out by the transference theory. Such considerations lead some to conclude that,

... this account of causation is incompatible with causal relations between successive stages of an isolated object. A causal relation between such stages would amount to caused natural changes. Such independent changes are expressly ruled out on the transference theory of causation. Hence, instead of helping to ground a causal theory of physical object identity, the transference theory of causation entails that successive stages of an independently persisting object are not causally connected.[332]

For example, imagine that an object's own inertia is the cause of its own continuing motion – perhaps a space-vehicle moving with constant rectilinear motion, which is not acted upon by any force. In this case, we want to say that the cause of the vehicle's continuing motion is its own inertia. It would even seem that earlier states of the vehicle are causes of the later states of the vehicle. However there has been no transfer of energy or momentum from one object to another and according to the transference

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[330] David Fair, 'Causation and the Flow of Energy', *Erkenntnis* 14 (1979) p.236.

[331] Aronson, 'On the Grammar of Cause', p.422.

[332] Ehring, 'Motion, Causation and the Causal Theory of Identity', p.193.

theory, this means that there is simply no causal interaction taking place.[333] The

transference theory cannot accommodate changes that occur despite a lack of external

influence, such as those required by causal perdurantism.

However, it can be argued that similar examples can be redescribed in such

a way that underlying transference *can* be found where there was thought to be none.

For example, it might be thought that a moving pendulum is a case which does *not*

qualify as a causal sequence as it involves only one object and therefore cannot be

recast in terms of transference. But of course this is not the case. The pendulum is a

causal process, and moves under the influence of external gravitational fields. If we

count fields as being among our catalogue of bona fide objects, (as surely we should),

we will see that actually, there is transference occurring. Similarly, we can posit the

existence of a chemical substance undergoing 'internal change', such as nuclear

decay.[334] Again, we find transference where there appears to be none. If the chemical

process is broken down to the molecular level, interactions involving transfer are

revealed. Yet neither of these strategies will do in the space-vehicle case. There are no

external gravitational fields to take the place of a second object and the vehicle's inertia

cannot be broken down into constituent parts in order to reveal transference.[335] At least,

this is the way the objection runs.[336]

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[333] This example is originally due to Phil Dowe in his 'What's Right and What's Wrong With
Transference Theories', *Erkenntnis* 42 (1995) p.366. For a similar point see: Michael Tooley's
'Introduction' in Ernest Sosa and Michael Tooley (eds.) *Causation* (Oxford: Oxford University Press,
1993); and Armstrong's *World of States of Affairs*, p.73-4. Note that this is just Armstrong's point when
he stipulates that genuine immanent causation cannot take place through the interaction of sub-particulars.

[334] An example given by Dougals Ehring, in his 'The Transference Theory of Causation', *Synthese* 67
(1986) p.250.

[335] Alternatively, we could deny that persistence is a kind of causation. That is, we could deny causal
perdurantism and move on to some other account of persistence. This is Aronson and Fair's preferred
strategy.

Is it really the case that causal transference cannot adequately be extended to immanent causation? We might want to say that any macro-object, such as our space-vehicle is an aggregate of smaller constituent objects. This is in fact what our best science *does* tell us. It might be that these micro-interactions are the real site of transfer of energy and/or momentum. In this sense then, transference can said to take place within one object. The question clearly rests upon how fine-grained we want our concept of an object to be. This begins to make sense if we concentrate on transference between the *spatial* parts of our space-vehicle - but what of the vehicle's *temporal* parts? Could it be that the temporal parts of the vehicle are causally connected, by way of energy and/or momentum transference? Recall that the transference theory requires that some quantity be transferred *from one object to another*. Can temporal parts be seen as objects, in this sense? Some think not, as is witnessed by the comment:

If we think of objects as worldlines - timelike worms, and think of the transference from one timeslice to another, we still have the problem that the energy hasn't been given a different object in the relevant sense. For transference to occur, the object which gains mustn't have had it before, and the object which gives it up must no longer have it. [337]

The question becomes - do two temporal parts of a single object count as two distinct objects? For Armstrong, they certainly do, as the temporal parts of a single particular differ in their respect to their properties.

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[336] We should note that not all transference theories of causation face this difficulty. For example, Salmon's mark transmission theory does not require cross-*object* transmission. Salmon's account merely requires transmission from one space-time point to another. The result of such fine-graining is that immanent transference or transmission becomes possible. That is, it allows for the transference of quantities (or, in Salmon's case, qualities), from one object to another, which takes place within some larger aggregate object. I will have more to say about Salmon's theory later.

[337] Phil Dowe, *Physical Causation* (Cambridge: Cambridge University Press, 2000), chapter 3.

We can distinguish between, and refer to, different phases in the existence of the same particular. Since the different phases will, in general at least, have different properties, we must recognize them as different particulars.[338]

Here, Armstrong makes use of the indiscernibility of identicals to argue that distinct temporal parts are different particulars. Because two temporal parts of a single particular do not share all properties, they are distinct, non-identical entities. This is all causal perdurantism needs in order to allow for immanent transference.[339] I want to allow the possibility of micro-transference *within* macro-objects. This may serve to go some way to dispelling the objection that the transference theory of causation rules out immanent causation. However, even if the theory can allow for immanent transference, a transference based account of persistence faces a second difficulty.

The identity conditions of physical quantities

A second problem for the transference theory involves the identification and re-identification of the quantities involved in transference.[340] The point is that if causation between the temporal and spatial parts of an object involves the transference of some quantity, say energy, it must be the case that it is *the very same* packet of energy that is

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[338] Amstrong, 'Identity Through Time', p.73-4.

[339] It goes without saying that Armstrong, although a causal perdurantist, does *not* hold the transference theory of causation, although his stance on the particularity of temporal parts would allow him to. Note also that physical objects, at bottom, cannot persist by way of micro-transference of quantities such an energy and momentum. If we grant the existence of 'unit' temporal parts, the transference story begins to unravel. What I mean is this. Imagine our space-vehicle. On perdurantism, it persists by way of causal relations between its temporal parts, where these parts are understood as the relativisation of the vehicle to a time interval $<t_1, t_2>$. Each of these temporal parts are constituted by smaller temporal parts, until we reach the level of temporal parts which, for the sake of argument, have no duration whatever - these basic temporal parts are to understood as the relativisation of the vehicle to a particular instant t. These 'instantaneous time-slices' cannot persist by way of transference between *their* temporal parts, as by definition, they have no duration.

first possessed by one part, and then possessed by another. This means that the theory merely pushes the question of identity through time down, from the level of objects to the level of quantities. The theory uses the notion of physical-quantity identity through time in order to explicate physical-object identity. Just what the persistence of *quantities* consists in, must be made clear.[341] Ehring offers an example whereby part of an object *A*'s energy is given to another object, *B*. Subsequently part of *B*'s energy is given to a third object, *C*. We can then ask; was *A*'s energy given to *C*? The conservation laws alone will not settle this question.[342] The lesson here is that when we move to many body problems the conservation laws appear to leave the question of the identity through time of the energy involved in transference indeterminate.[343] However, I would argue at this point, that the identity of these quantities is anything but indeterminate. The question, as to which energy goes where, is merely a hidden fact. Identifying and

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[340] Quine has argued that this re-identification requires that we treat energy as though it, like matter, were traceable from point to point through time. How we do the same for momentum is a mystery to the writer.

[341] As Ehring has noted "we are probably clearer about the latter [physical-object identity] than the former [physical-quantity identity]." 'Motion, Causation and the Causal Theory of Identity', fn. 27.

[342] Ehring, 'The Transference Theory of Causation', p.256.

[343] To be fair, transference theorists *do* attempt to specify conditions for the identity through time of physical quantities. In his Causation and the Flow of Energy', p.234, Fair argues that the conservation laws function as a technique for identifying the energy possessed by an object at one time, as being (part of) the energy that was possessed by another object at an earlier time. The idea here is that the conservation laws themselves entail the identity through time of quantities such as energy and momentum. Similarly, Aronson argues that 'transform', 'transfer', 'convert', 'exchange' and so on are terms whose application necessarily involves identity through time. The concept of the laws of conservation is said to presuppose some identity of quantities. So, if in a causal interaction some amount of energy were annihilated and subsequently recreated, rather than transferred, the conservation laws would be violated. This means that the laws require the numerical identity of a transferred quantity, rather than the numerical *equality* of that quantity. It is not enough that the *same amount* of energy and/or momentum appears in the effect, as was earlier manifested by the cause - the *self-same* quantity must reappear. Therefore, denying the numerical identity of the quantities involved in transference is said to be incompatible with conservation principles. See Aronson's 'On the Grammar of Cause', p.149.

re-identifying numerically identical portions of energy and/or momentum may be difficult, perhaps even physically impossible, but this does not mean that identity is not involved.[344] Assuming that the physical quantities involved in transference *do* retain their numerical identity through time, how is this identity effected? The answer to this question leads to a third difficulty for transference based causal perdurantism.

Transference and circularity

This third difficulty takes us back to circularity. Transference-based causal perdurantism is confronted by two circularity charges, both of which cannot be diffused, unless identity assumptions are built into the theory.

First, the identity through time of the physical quantities involved in transference might lead to circularity. For example, imagine that C causes E. This is achieved by way of the transfer of some packet of energy p, from C to E. As p remains numerically identical throughout the interaction, *its* identity must be accounted for. The question of physical-quantity identity can be resolved in a number of ways. However, one option is expressly ruled out. It must not be the case that the persistence of p is also transference based. That is, "we cannot of course hold a transference theory of physical *quantity* identity."[345] In fact, the persistence of this transferred entity cannot be *causal* at all, be that causation transference-based or otherwise. More specifically:

[I]t is circular to suggest that c directly causes e only if some entity is transferred from c to e if we then go on to claim that stages of this entity form a continuing entity only if these stages are causally connected.

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[344] Another stategy, suggested by Dieks in his 'Physics and the Direction of Causation', *Erkenntnis* 25 (1986) pp.85-110, is to deny that energy and momentum have identity at all. But Aronson and Fair do not have this option. Clearly, transference theory requires that the same quantity be transferred. If not, immaculate annihilation/ recreation cases are not ruled out and will qualify as causal. That is, the distinction between causal and pseudo processes will be lost. In addition, the transference-base of the theory will be weakened to the point that all talk of transfer becomes merely metaphorical.

[345] Ehring, 'Motion, Causation and the Causal Theory of Identity', fn.27 (emphasis added).

Hence, this final suggestion [that causation consists in the transference of some entity], which is the only plausible one for cashing in the notion of a mechanism for carrying causal influence from causes to their direct effects, is acceptable only if the causal theory of identity thesis is rejected.[346]

Second, it might seem that some sort of circularity is inherent in the very *expression* of transference-based causal perdurantism. The idea here is that circularity springs from the fact that the identity through time of physical objects has been assumed in the formulation of the transference theory of causation. As we have seen, according to Fair, a necessary and sufficient condition of a causal case is the transference of some numerically identical portion of energy and/or momentum *from one object to another object*. Now, if this transference is constitutive of identity, it is of course the case that there is only one object involved. That is, in this kind of causation, what is needed is the transference of some numerically identical portion of energy and/or momentum from one object to a numerically identical object - that is to *the very same object at a later time*. Note that the problem here is not the identity of physical *quantities* through time, but rather, the identity of physical *objects* through time. Recall this is the very question at issue. Therefore,

... the notion of transference used here presupposes the notion of physical object identity. A quantity is transferred over time only if that quantity is possessed by an object at one time and by *another* object at a later time. There simply is no transfer if the second object is the same object at a later time as the first object. In order to apply the transference theory of causation, we must already be in a position to make judgements of physical object identity and non-identity. Hence, a transference/causal theory of object identity is circular.[347]

Perhaps a solution to this problem can be found in an earlier-made distinction. I said earlier that immanent transference could only be countenanced if we

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[346] Ehring, 'Preemption, Direct Causation, and Identity', *Synthese* 85 (1990) pp.67-8.

[347] Ehring, 'Motion, Causation and the Causal Theory of Identity', p.193.

shift our attention from macro-objects to their constituent parts. Call these mac-objects and mic-objects respectively. We can now say that a necessary and sufficient condition of a causal case is the transference of some numerically identical portion of energy and/or momentum *from one mic-object to another mic-object*. Notice that it is the identity of mac-objects - that is at issue here. Notice also that all mention of mac-objects has disappeared from the analysis. Therefore, the identity through time of mac-objects is generated by transference. However, that transference does not take place between mac-objects, but between mic-objects, that is between the constituent parts of mac-objects. In other words, we might think that the allowance of immanent transference has provided a solution to this second charge of circularity.

Nevertheless, this will not do, for how are we to analyse the identity through time of these 'mic-objects'. All we have done is pushed the problem from the level of the persistence of mac-objects to the persistence of their constituent parts.

In the preceding discussion, the transference theory of causation has been extended in two ways, in order to render it a viable candidate for explaining causal identity. Firstly, immanent transference is possible, that is, it is not ruled out *a priori*. Secondly, energy and momentum do retain identity through time, but not causally. This point was introduced in order to avoid circularity.[348] Finally, transference theory must be tested against the challenge of RDA. I will argue that even an extended version, (one that allows for both immanent causation and the non-causal persistence of quantities) cannot succeed in this regard.

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[348] This might seem rather *ad hoc*. After all, every one of these amendments has been made in order to overcome some objection to transference-based account. However, the extension has been made in the spirit of enquiry. It seems the only way to evaluate transference theory's chances at explicating causal perdurantism.

Suppose we formulate a transference-based account in which we allow for immanent transference between the parts of some macro-object, where the persistence of what is transferred, (for the sake of argument, energy and/or momentum), is a matter of endurance rather than perdurance. For example, suppose that at t_1 the *NW* quadrant of a perfectly homogenous sphere possesses quantity Q, but at t_2 quantity Q has been transferred to the *SW* quadrant. Can we tell if the sphere is rotating? Certainly, the sphere *could* have rotated, because Q is now in a different quadrant but is possessed by the same part of the sphere. Equally, it could be that the sphere has remained stationary. That is, it might be the case that Q has migrated from one part of the sphere to another without rotation. In other words, tracing the trajectory of the quantity Q alone will not differentiate between rotation and stasis.[349]

Invariant quantity theory

I now want to discuss two theories of causation that fall under the broad title of 'process theories'. These theories see causation as not a relation between events, but as a characteristic of continuous processes. Under these theories, causal processes propagate causal influence. The first is the invariant quantity theory, the other the conserved quantity theory.

Wesley Salmon has proposed the invariant quantity theory of causation[350] Salmon's invariant quantity theory can be characterised in this way.

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[349] See Ehring's 'Motion, Causation and the Causal Theory of Identity' for a similar point.

[350] Note that Salmon originally proposed the mark transmission theory but has since abandoned it. See Phil Dowe's 'Wesley Salmon's Process Theory of Causality and the Conserved Quantity Theory' *Philosophy of Science* 59 (1992) pp.123-128, for a clear exposition of Salmon's early theory. The mark transmission theory has several advantages over the transference theory. Recall that one objection to that theory was that it cannot identify an amount of energy as being the same as an earlier quantity. It was

IQ1: A causal intersection is an intersection of world lines, which involves the exchange of an invariant quantity.

IQ2: A causal process is a worldline of an object that transmits a non-zero amount of an invariant quantity at each moment of its history.

IQ3: A process transmits an invariant quantity from A to B if and only if it possesses this quantity at every stage between A and B, in the absence of interactions involving that quantity.[351]

Can causal perdurantism, under an invariant quantity framework, resolve rotating disc arguments? In RDA cases we want to find some difference within the sphere that will determine the state of motion of that sphere. On invariant quantity theory interactions involve an effect possessing only the same *kind* of quantity as was previously possessed by the cause. Imagine that a portion of the sphere, p manifests a certain charge, and is in the SW at t_1. All of the other sphere portions manifest an invariant quantity of this kind – namely charge. If portion p persists through time as the sphere rotates, it will possess the same kind of invariant quantity throughout the interval of rotation. But similarly, two distinct sphere portions, p and q in a stationary sphere

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replied that the identity through time of energy can be characterised by specifying a closed system about the processes in question. The conservation laws together with the fact that the object is the same object will allow us to identify and re-identify both energy and momentum. But a problem remains. We still cannot tell *which* object in closed system retains a quantity of energy. Salmon's replies that the identification and re-identification of quantities is effected by marks. Invariant quantity theory differs from the mark transmission theory in its characterisation of a causal process. The capacity for mark transmission is replaced by the transmission of an invariant quantity, where an invariant quantity is just any quantity that is considered to remain invariant in all frames of reference.

[351] Wesley Salmon, 'Causality without Counterfactuals', *Philosophy of Science* 61 (1994) pp.297-312. See Dowe's 'What's Right and What's Wrong With Transference Theories' for an extended discussion of invariant quantity theory. A claimed advantage of this theory is that it is free of the counterfactuals which caused trouble for Salmon's earlier attempt (the mark transmission theory). Dowe calls for a revision of

might possess the same kind of invariant quantity. Therefore no difference has been shown, and a causal perdurantist account, where causation is seen as the exchange of invariant quantities, will fail in RDA contexts.

In fact, things are worse that this. Since the sphere is homogeneous, we can assume that all sphere-portions will manifest the same amount of charge, same amount of momentum, and same amount of mass/energy. Because it impossible to track exchanges of invariant quantities within the sphere, there is no way that they could 'make the difference' between rotation and stasis. We might say that the invariant quantities can be tracked throughout the sphere, by reference to the portions of the sphere that manifest them. Quantity q is in the *SW* quadrant at t_1 and the *NW* quadrant at t_2, because one portion of the sphere p, that manifests q, is known to have travelled by way of rotation from the *SW* quadrant to the *NW* quadrant. But of course this will be circular. Invariant quantities are subject to the dilemma, which by now should be familiar.

Conserved quantity theory

Another process theory of causation is conserved quantity theory, formulated by Dowe. On this theory, a causal interaction is an intersection of world lines which involves the exchange of some conserved quantity. A causal process is the world line of an object that manifests a conserved quantity, where a world line is understood as a collection of points on a spacetime diagram that represent the history of an object. A conserved quantity is any quantity that is considered to be universally conserved, according to current scientific theories. Examples include mass-energy, linear momentum, angular

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IQ2 to "A causal process is a world line of an object that *possesses* a constant amount of a non-zero invariant quantity at each moment of its history". Salmon has since agreed.

momentum, and charge. An exchange must involve at least one incoming and at least one outgoing process, and manifest a change in the value of the conserved quantity, where outgoing and ingoing are seen in terms of the backward and forward light cones on a Minkowski diagram. Conservation laws govern the exchange of quantities. An object is anything that counts in the ontology of science, such as particles, waves, fields and anything from common sense. Causation is a property of processes and interactions, and an earlier segment of a causal process can be the cause of a later segment. Conserved theory is summarised as follows.

CQ1. A causal interaction is an intersection of world lines which involves exchange of a conserved quantity.

CQ2. A causal process is a world line of an object that possesses a conserved quantity.[352]

According to the conserved quantity theory, the worldline of an object possessing conserved quantities counts as a causal process. In relation to the identity through time of objects, Dowe stipulates that an object must be wholly present at a time to exist at that time. When we consider an object at a time, it is not true that strictly speaking we have only part of the object (temporal part). We in fact have the whole object at that time under consideration.[353] The conserved quantity theory also entails that genuine causal objects are the ones that possess certain properties at a time. Genuine causal processes over time are given by way of an additional presumption of a relation of identity through time.

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[352] Dowe, 'What's Right and What's Wrong With Transference Theories'.

[353] Note that Dowe's thinking on the identity through time of objects has changed over time. In his *Physical Causation* he argues that the conserved quantity theorist can adopt endurantism, but need not do so (see pp.101-109).

Thus: an electron existing at a point in time is causal because it possesses charge, and its worldline represents a causal process, assuming that the worldline represents one and the same object over that time interval. To adopt the four-dimensional conception would require some further way of ruling out time-wise gerrymanders.[354]

The conserved quantity theory is not concerned with the identity through time of quantities. In this, it differs from the transference theory, which attempts to rule out these time-wise gerrymanders, or pseudo-identities by appealing to the identity over time of quantities themselves. As we have seen in a previous discussion this is fraught with difficulties. Dowe maintains that scientific quantities are not ascribed to objects in a way that is essentially spatially localised. Rather, they are ascribed in a way that is *temporally* localised. Scientific quantities are possessed at a time where times are thought of as point-instants. Quantities are not smeared over time in the way they are smeared over space. It is incoherent then, to think of these quantities as persisting through transference, or exchange. Conserved quantity theory involves no notion of transference, transmission or exchange, only the notion of quantity *possession*. In addition, conserved quantity theory differs significantly from invariant quantity theory. Unlike invariant quantity theory, conserved quantity theory does not require that a causal process possess a *fixed* amount of a quantity over the entire history of the process.[355] Salmon wants a causal process to possess the required quantity at each moment of its history. For Salmon, if the object exists at a time then it must possess the quantity at that time. Under conserved quantity theory, if a thing has a conserved

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[354] Ibid., p.330.

[355] Another difference is that Salmon stipulates that the amount of a quantity possessed must be non-zero. Dowe claims on the contrary that causal objects can possess a zero amount of the quantity in question. The worldline of an object at rest is still a causal process, according to Dowe despite the fact that it has zero momentum. If such an object enters into an interaction, its zero momentum will certainly make a difference.

quantity, it always has it. Things look very different, however if we build in the requirement is that an object possesses a quantity at every moment of a *relevant interval*. This introduces the notion of spatiotemporal continuity, and means that a causal process cannot be discontinuous. Conserved quantity theory has no such commitment to continuity. Conserved quantity theory merely requires that a quantity be possessed, and not that it be possessed in any specific magnitude. For Dowe,

> ... the CQ Theory is not concerned with how much momentum the object possesses, just whether it is the type of object that possesses such a quantity. *That* the object possesses momentum is a fact that does not vary with the frame of reference. The concept of an exchange of momentum also is invariant, since change in momentum is invariant.[356]

The conserved quantity theory does not require that the effect possess the same quantity as was had by the cause. In fact, it does not even require that the effect possess the same *amount* of the conserved quantity as the cause. For this reason, it does not have worries about the identity of quantities. Similarly it does not have worries about the identity of objects as this has been stipulated as being primitive. This means that CQ will not be circular if applied to rotating disc arguments. However, this is just the point. Dowe stipulates that the identity of objects is primitive *in order that* circularity is avoided.

4.4 Summary

In this chapter, I have presented a prima facie case against causal perdurantism. It turns out that each of the theories of causation scrutinised here, stumbles when it comes to rotating disc arguments. In the case of the Humean theories of causation, pseudo-identities cannot be ruled out (and therefore facts of motion not specified) unless facts

of motion are assumed. The ensuing circularity seems like a good reason for abandoning accounts of identity, which see causal relations between the temporal parts of objects as a matter of regularity. We have also seen that non-Humean theories fall down in this regard. This is because, in attempting to find that factor, strong enough such that pseudo-identities are ruled out, the causal theory inevitably smuggles in the offending identity facts. In the next chapter, I will turn to an examination of another theory of causation. This theory, perhaps has learnt the lesson of this chapter, for it does not pretend that a theory of causation can be formulated without making reference to persistence. In fact, on this theory, causation *just is* persistence. However, as we will see although this might help in the case of rotating disc arguments, it will not dispel certain other problems.

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[356] Ibid., p.119.

Chapter 5: Causation as trope endurance

The focus of this chapter is the trope-theoretic account of causation put forward by Douglas Ehring. To begin, (§5.1) I will outline that theory of causation, according to which causation's singularist component is best understood as the partial persistence of tropes. In the following section (§5.2) develops this outline with reference to certain patterns of partial trope persistence, and the theory's debt to the views of John Mackie. I will then argue that Ehring gives us no good reason to think that property instances are tropes rather than exemplifications of universals. I will also argue that his argument for the persistence of tropes is unsatisfactory (§5.3). The following discussion (§5.4) applies the persistence theory of causation to rotating disc arguments. Finally, I will examine the performance of the enduring trope view in regard to the problems of change in temporary intrinsic properties (§5.5), and changes in parts (§5.6) which were first introduced in chapter one. It turns out that a theory of causation based on persisting tropes can avoid RDA. However, because the theory posits enduring tropes as the relata of causation, it must face the two problems for the endurantist, outlined in chapter one. As will be seen, the persistence theory of causation cannot provide solutions to either the problem of temporary intrinsics, or the Russell-minus problem.

5.1 Ehring's persistence theory of causation

Ehring's persistence theory of causation is an attempt to characterise the singularist component of causation. Ehring is also a causal reductionist - causation is not some further fact over and above the non-causal facts. For Ehring, the truth-values of singular causal statements are logically determinable without reference to any statement about

causal facts regarding particulars.[357] Ehring attempts to formulate an account of

causation's singularist component that can avoid the pre-emption-pairing problem, and

avoid rotating disc arguments without becoming circular. In this section, I will outline

the persistence theory of causation.

The mechanist thesis

Persistence theory can be introduced by way of the 'Mechanist Thesis'.[358] This thesis

breaks down into four sub-theses, all of which will be discussed in turn. The first thesis

states that there is a causal mechanism, whilst the subsequent three theses specify the

nature of that mechanism. The mechanist thesis is as follows:

(1) Mechanism Proper: There is a mechanism for the transmission of an event's causal

influence not only to its indirect effects but also to its direct effects;

(2) The Identity-Based Character of Causal Mechanism: The mechanism that carries

causal influence from a cause to its direct effect must be characterised in terms of the

notion of identity over time;

(3) Non-Spatio-Temporal/Non-Nomological Theory of Identity: The identity over time

of the 'entity' that carries direct causal influence cannot be analysed in terms of

spatiotemporal relations or laws;

(4) Noncausal Theory of Identity: The identity over time of the 'entity' cannot be

analysed in causal terms;

       Mechanism proper states that there exists a mechanism or relation S that

causes bear to their direct effects such that: i) S is the means by which causal influence

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[357] Douglas Ehring, *Causation and Persistence: A Theory of Causation*, (Oxford: Oxford University Press, 1997), pp.61-3.

[358] Ehring, *Causation and Persistence*, p.51.

is transmitted to direct effects; ii) S does not consist in a causal chain, since this would collapse direct causation into indirect causation; and iii) Given the rejection of causal realism, S is not the causal relation itself.[359] So on this third thesis, there is no causal answer to the question of how causes bring about their effects. This thesis also entails that direct causation is possible, that is it denies that whenever one event is causes another, there is some mechanism connecting these to events in the form of causal intermediary events.

Ehring maintains that only a mechanist theory of causation can solve the preemption-pairing problem. This is just the problem that a given effect e, caused by c_1, would still have occurred (or might have, in indeterministic cases) had c_1 not occurred because there is some other event c_2 which would have caused e in the absence of c_1. The pairing problem is just the problem of getting e to pair up with c_1 but not c_2. The introduction of persisting tropes, it is claimed, means that there is always a causal process connecting the preempting cause, but not the preempted cause to its effect. Or:

Although e is qualitatively indistinguishable from the effect which would have occurred in the absence of c_1, there is a difference in trope tokens. e has its trope given to it, as it were, by c_1: e possesses a trope that is the very same (token) trope previously possessed by c_1. Whereas if c_1 had not occurred the trope possessed by e would have come from c_2 instead: hence it would have been a numerically distinct yet qualitatively identical trope.[360]

Both transference theories of causation and Ehring's persistence theory can overcome the preemption-pairing problem. This is because both are mechanistic and as such, tell

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[359] Ibid., pp.54-5.

[360] A characterisation of Ehring's solution to the pairing problem due to Helen Beebee in her *Review of Douglas Ehring's 'Causation and Persistence: A Theory of Causation'*, (circulated manuscript) p39.

some story about *how* causal influence is transmitted from cause to direct effect.[361]

Ehring concludes that persistence theory is adequate to this task. It succeeds where others fail because it includes the notion of property (or trope) history.[362]

The second thesis implies that there exists a mechanism or relation S that causes bear to their direct effects such that: i) S is the means by which causal influence is transmitted to direct effects; and ii) S consists in the persistence of something.[363] This second thesis constrains the nature of causal mechanism, and means that a full analysis of causation must be predicated on a prior concept of identity. In arguing for (2) Ehring canvasses several candidates for the causal mechanism S. First, he investigates the possibility that S might be some spatiotemporal relation. However spatiotemporal conditions such as priority and contiguity are rejected on the grounds that they preclude the possibility of simultaneous causation, backward causation and action at a distance. In addition, a spatiotemporal analysis of causal mechanism is said to fall foul of the pre-emption-pairing problem.[364] The second possibility is that causal mechanism is best characterised as some nomological relation. Ehring rejects any nomic account of mechanism, as its locus is found in type-level relations, and this, it is claimed, moves away from the search for the singularist component of the causal relation.[365] Thirdly,

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[361] In his *Causation and Persistence*, p.52, Ehring argues that nomic, counterfactual and probabilistic approaches to this problem are unsatisfactory, however space does not permit an investigation of this claim.

[362] In her *Review of Causation and Persistence*, p.183 Beebee argues that persistence theory cannot avoid the preemption-pairing-problem as Ehring claims. She argues that if what makes genuine compound tropes genuine are generalist factors, Ehring will continue to face the pairing-problem.

[363] Ehring, *Causation and Persistence*, p.58.

[364] Ibid., p.55.

[365] Ibid., p.55-6. In addition, Ehring (p.56) argues that a nomological characterisation of causal mechanism cannot resolve the pre-emption-pairing problem.

Ehring considers (and then advocates), an analysis given in terms of persistence.[366] Such accounts are not novel. Recall the transference theory, discussed in the previous chapter (§4.3). This theory also implies the identity through time of some 'entity' (in this case energy and/or momentum).[367] Ehring claims his theory is related to the transference theories, and other theories inspired by it. However, it is not a transference account, as will be seen.

The third thesis encapsulates the claim that the persistence of this 'entity' is not solely a matter of spatiotemporal or nomological relations between temporal parts. The persistence theory of causation excludes certain accounts of persistence.[368] Ehring requires thesis (3) in order to guarantee thesis (2) – in short, he wants mechanism to be necessarily incompatible with spatiotemporalism. If the persisting entity's identity conditions were solely a matter of spatiotemporal relations, then the local token-level relation between cause and direct effect could be fully characterised in spatial and temporal terms, which is precluded by thesis (2).

The fourth sub-thesis is added in order to avoid circularity. The persistence theory of causation cannot accompany causal perdurantism (or at least not accompany a causal account of the persistence of the 'entity' in question). That is:

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[366] Ehring concludes, "The spatiotemporalist and nomological interpretations of S are inadequate. That leaves the persistence interpretation." *Causation and Persistence*, p.58. Such arguments (resting on the somewhat dubious method of elimination) are only as good as the completeness of the class considered. We might think there are other contenders for the analysis of mechanism, but clearly Ehring does not.

[367] Other identity-based theories of causation include Salmon's early mark theory, (persistence of a certain causal structure), and Castaneda's causity theory. Note that the transference and causity theories require cross-object transmission, whereas the mark theory does not (although it does require transmission of a mark from one space-time point to another).

[368] Ehring, *Causation and Persistence*, pp.58-9.

An analysis of causation must not make use of concepts that are themselves analyzed causally. In particular, a persistence theory of causation must not make use of causally analyzed concepts. In other words, the persistence of the relevant "entity" should not be analyzed causally. The entity's persistence must not be a matter of causally connected temporal stages. This condition is required to avoid circularity. It is circular to suggest that *c* directly causes *e* only if some entity is transferred to *c* to *e* if we then go on to claim that stages of this entity form a persisting entity only if these stages are causally connected. Cashing out the notion of a mechanism for carrying causal influence by reference to a persisting "entity" is acceptable only if the persistence of this entity is not analyzed causally.[369]

Now, this may seem an obvious point given the discussion of the previous chapter. In that chapter, I showed that not all causal theorists are as careful as Ehring. As an example of this carelessness I discussed the transference theory of causation, according to which causation is analysed as the transference of packets of energy from cause to effect. I argued (§4.3) that such an account only makes sense if it is the case that the self-same energy is passed from cause to effect. It is not sufficient that the effect manifests the same amount of energy – it must manifest the same energy as was had by the cause. It is clear that the persistence of that energy must not be analysed causally, for that would be directly circular. Ehring explicitly avoids this kind of circularity, as the persistence of the entity in question is stipulated to be non-causal in nature.

In summary, the mechanism thesis tells us that there exists a mechanism or relation *S* that causes bear to their direct effects such that: *S* is the means by which causal influence is transmitted to direct effects; *S* consists in the persistence of some entity; and the persistence of that entity is not solely a matter of spatio-temporal or nomological relations, and the persistence of that entity cannot be analysed causally.

Ehring adds two further restrictions to fill out his mechanistic theory. First, nomological relations are considered neither necessary nor sufficient for *S*, the

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[369] Ibid., pp.59-60.

singularist component of causation. In addition, nomological relations are neither necessary nor sufficient for the persistence of the entity involved in mechanism.[370] Or:

(5) Non-Nomological Theory of Identity: The identity over time of the 'entity' cannot be analysed in terms of nomological relations.

This is shown, says Ehring, by the 'only t_1 through t_2' principle. According to this principle: whether a at t_1 and b at t_2 are identical, depends solely on facts about a and b and on properties that are realised between t_1 and t_2. Matters of persistence cannot rely on facts that are temporally extraneous to the relevant entity. Laws are ruled out, as they are non-local. Laws imply things about what happens before t_1 or after t_2.[371] Ehring concludes that laws of nature, conceived of as necessitation relations between universals also fail the 'only t_1 through t_2' principle. This is because on such a view, this necessitation relation entails the corresponding regularity. Ehring argues that since persistence is solely a matter of temporally local facts, and laws either supervene on, or entail temporally global facts, nomological relations are not a necessary condition for identity through time. Therefore, nomological relations are not necessary for the persistence of the entity posited by a mechanistic theory of causation.[372]

The second restriction placed on the mechanist thesis is that the mechanism for carrying direct causal influence must be compatible with many-one and one-many causal patterns. This is dictated by the fact that events usually have multiple causes and

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[370] Ibid., pp.60-1.

[371] This is a contentious view. Are laws of nature really non-local? We might think that Ehring's claim is limited to a Humean regularity theory of laws. The question of what regularities are true of a certain process during a definite period depends also on what happens at other temporal regions. But if laws are relations between universals, do they remain non-local? Not necessarily, for it might be that instantiations of laws of nature are actually local intrinsic matters of fact (a view held (independently), by both Armstrong and Mellor). See Armstrong's claim to this effect in his *What is a Law of Nature?*, p.85.

effects. The entity that persists through time must be capable of fission and fusion, such that this final condition holds. We can put this in terms of a final condition:

Partial Persistence Condition: The 'entity' that carries direct causal influence must be capable of partial persistence through time.[373]

5.2 Tropes as causal relata

We have yet to uncover the nature of this 'entity', the persistence of which constitutes the mechanism through which causal influence is transmitted from cause to direct effect. Ehring argues that this entity is a trope. Tropes are spatio-temporal particulars that exist wholly at each moment of their realisation. That is:

> With any persisting entity, including tropes, different interpretations of what that persistence consists in are possible. On one view, a persisting trope has temporal parts, and the trope's persistence consists in the holding of certain relations, typically including causation, among the temporal stages. We are familiar with the temporal parts view from the literature on personal identity and physical object identity. The other interpretation is nonrelational. On this view, the persisting entity has no temporal stages. A trope's persistence will then consist in the trope's being present or realized wholly at each moment of its duration. I defend this three dimensional perspective.[374]

The idea that tropes persist is unusual in itself, but the idea that they might endure through time is even stranger. Causal relata do not generally occur at more than one temporal point, but Ehring's persisting tropes do. To overcome this problem, Ehring

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[372] Ehring, *Causation and Persistence*, pp.60-61. This fifth condition also rules out certain kinds of causal theories of identity such as that of David Armstrong, discussed at (§4.1).

[373] Ibid., p.61. See (§5.2) for a more detailed discussion of the partial persistence of this entity through fission and fusion.

[374] Ibid., p.14.

claims not that tropes *per se* are causal relata, but that a causal relatum is the realisation of an individual property at a time.[375]

The cement of the universe

In positing properties as the relata of causation, Ehring is drawing on the work of John Mackie in regards to qualitative persistence. Ehring claims to be following Mackie in his advocacy of a non-spatiotemporalist persistence-based account of causation.[376] Mackie argues that qualitative or structural continuity constitutes something 'over and above complex regularity' and that these mechanisms constitute the 'long searched for link' between cause and effect.[377] Certain forms of persistence constitute this link. The agenda is to extend the concept of causation to include certain forms of persistence, in order to defend the view that the apparent heterogeneity of macroscopic causes and effects masks the qualitative and spatiotemporal continuity that exists at the micro-level. The sequences of these widespread causal mechanisms fall under what Mackie calls basic laws of working. I have already discussed these laws of workings in a previous chapter (§4.1).[378] As was pointed out in that earlier discussion, Mackie argues that the main error of the regularity account of laws lies in its conception of necessity. A new notion of necessity is required if we are to explain why it is that basic laws of working carry necessity and accidental regularities do not. Accordingly, Mackie argues that things that causally interact have insides, or internal processes which we do not, (or

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[375] Ibid., p.115. This contrasts with the Kimian view that causal relata are exemplifications of universals by an object at a time.

[376] Ibid., p.116.

[377] Mackie, *Cement of the Universe*, p.224.

[378] That discussion occurred in the context of the failure of Humean regularities to distinguish between nomic and accidental universal truths.

cannot), perceive. The necessary connections between these internal features of things are hidden from us. However, when we assert a natural law, we do not claim to know it as necessary. Rather, we conjecture the necessary connection because of external features. For this reason, Mackie calls for a transcendent hypothesis through which we (contra Hume) *are* licensed to posit necessary connections.[379] Mackie concludes with the suggestion that we,

... advance beyond a view of causation as mere succession when we conjecture that there really is some causal mechanism underlying the succession and explaining it.[380]

For, Mackie laws of working, and therefore causation, are inextricably linked to qualitative persistence and continuity. For example, he says:

We may suggest, then, that basic laws of working are, in part, forms of persistence. ... I argued for extensions of the concept of causing to include both the persistence of objects and the persistence of self-maintaining processes, saying that in both of these we could regard an earlier phase as a cause and a later phase as an effect. I am now suggesting that this sort of causing plays a larger part, underlying processes that at the perceptual level are cases of unrelieved change, of a cause being followed by an utterly different effect. A match is struck on a matchbox and a flame appears: on the face of it this effect has nothing in common with its cause. But if we were to replace the macroscopic picture with a detailed description of the molecular and atomic movements with which the perceived processes are identified by an adequate physico-chemical theory, we should find far more continuity and persistence. ... What is called a causal mechanism is a process which underlies a regular sequence and each phase in which exhibits qualitative as well as spatio-temporal continuity.[381]

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[379] Ibid., p.228.

[380] Ibid., pp.216-217. Note that in response to the Humean objection, that we never perceive such necessary connection, Mackie follows Kneale, and makes the point that the Humean project is based on a mistaken doctrine of perception. What is required is realism about certain features and processes that are hidden from our view.

[381] Ibid., p. 221-22.

At least at the microscopic level, cause and effect display either complete or partial

qualitative persistence (and spatiotemporal continuity). Qualitative persistence and

spatiotemporal continuity constitute

... a general characteristic of causal processes, sometimes observable, sometimes not, which constitutes a
link between cause-events and effect-events similar to but more selective than the relation defined by
Ducasse, since it relates specifically relevant causal features to those features which constitute the
result.[382]

So, for Mackie a singular causal sequence,

... instantiates some pure law of working which is itself a form of partial persistence; the individual
sequence therefore is, perhaps unobviously, identical with some process that has some qualitative or
structural continuity, and that also incorporates the fixity relations which constitute the direction of
causation.[383]

But Mackie is not claiming that all causation involves persistence.[384]

Interaction is the exception. This is because 'the most we can expect is that there should

be more persistence mixed with the differences', and in the case of interaction, 'it seems

inescapable that there could be a law of working which is not just the persistence of

anything.'[385] The basic thesis is that causal mechanism or continuity of process

constitutes the necessity found in basic laws of working. Contiguity enters the picture as

that which makes qualitative and structural continuity possible. The persistence theory

of causation is formulated in the spirit of this account, although Ehring abandons

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[382] Ibid., p.229.

[383] Ibid., p.229.

[384] In fact, neither is Ehring. For details see his *Causation and Persistence*, p.99.

[385] Mackie, *Cement of the Universe*, p.222.

Mackie's requirement of spatiotemporal continuity.[386] Mackie concludes that causation is the 'cement of the universe'.

It is, then, causation, in the sense of what satisfies the wider and richer concept for which I have argued, that holds the universe together, that makes it more than just a collection four-dimensional scenery. Moritz Schlick, like others in the Humean tradition, was very critical of the notion of a causal tie: 'After the scientist has successfully filled up all the gaps in his causal chains by continually interloping new events, the philosopher wants to go on with this pleasant game after all the gaps are filled. So he invents a kind of glue and assures us that in reality it is only his glue that holds the events together at all. But we can never find the glue; there is no room for it as the world is already completely filled by events which leave no chinks between them.'[387] But this criticism does not touch the view for which I have argued. Causation is not something between events in a spatio-temporal sense, but is rather the way in which they follow on another. It involves regularities, universal or statistical, in particular what I have distinguished as pure laws of working, but it is not exhausted by them; it includes also the spatio-temporal continuity stressed by Ducasse, the qualitative or structural continuity, or *partial persistence*, which I have sorted out from Kneale's more rationalist concepts, and the features which constitute the direction of causation.[388]

For our purposes, two themes emerge from this discussion. They are themes that are taken up by Ehring in his trope-theoretic account of causation. They are Mackie's claims that: (1) causation must involve some mechanism, and (2) that this mechanism consists in part, in the persistence of qualitative or structural form.

The alphabet of causation

For Ehring, all causal processes exhibit qualitative persistence. Elementary causal processes, which are common, consist in individual properties that persist unchanged. However, complex causal processes exhibit assorted patterns of partial trope

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[386] Ehring, *Causation and Persistence*, p.117.

[387] Morris Schlick, 'Causality in Everyday Life and Recent Science', in *Readings in Philosophical Analysis*, H. Feigel and W. Sellars (eds) (New York: 1949), p.522.

[388] Mackie, *Cement of the Universe*, p.296 (emphasis added).

persistence. Interactions also have complex forms of trope persistence. A trope's

persistence may not be complete. The partial persistence of tropes is possible because

there exist compound tropes. Tropes at different times may even partially overlap, and

there exists a diversity of types of causal processes that correspond to different patterns

of trope persistence. There are three main patterns of trope persistence: full trope

persistence, partial trope persistence through fission and partial trope persistence

through fusion.[389]

A simple trope (for example, a minimum-charge trope) has no other tropes

as proper parts. A compound trope on the other hand, does have tropes as proper parts.

Compound tropes occur in two varieties: conjunctive-compound tropes, which involve

the conjunctive compresence of more than one trope, (for example, a non-minimum

electrical charge trope), and structural-compound tropes (for example, the length of a

piece of string). Such structural-compound tropes are comprised of a trope F standing in

a certain relation R (another trope) to another trope G. Compound tropes may simply

persist, partially persist through fission, or partially persist through fusion.

When a conjunctive-compound trope fissions, the tropes that formerly

constituted it cease to be compresent. When a structural-compound trope fissions, the

tropes that formerly constituted it cease to stand in the relation that was partly

constitutive of that compound-structural trope. A fissioning trope is partially identical to

the simpler tropes that formally constituted it.

Tropes can also partially persist through fusion. Fusion occurs when tropes

come together to form either a conjunctive or structural trope. They form a conjunctive-

compound trope if some tropes become compresent, but form a structural-compound

trope if they come to stand in some constitutive relation. The fusing tropes are partially

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[389]Ehring, *Causation and Persistence*. pp.122-28.

identical with the complex trope that they come to form. Trope fusion also occurs in two ways. Stable-trope fusions occur when a fusion is formed that will remain intact unless acted upon by some extrinsic factor. An unstable-trope fusion occurs when a fusion is formed that will fission, or is likely to fission, due to the existence of some relevant law of nature. So on this view;

Nonsimple individual properties are conjunctive/structured bundles of properties. Both simple and nonsimple properties may persist. Causation's singularist component consists in the persistence of such properties, along with the forming and unforming of such property bundles. Tropes are the alphabet of causation, and the cement of the universe consists in constancy and survival of its properties.[390]

How much sense does this picture make? I suspect it makes more sense in some scenarios than others. Take, for example Ehring's own example of trope fission, which is based on a chemical reaction. The break-up of ethane C_2H6 results in the formation of methyl radicals, $*CH_3$.[391] We can represent this reaction like so;

Figure (1) Partial trope persistence through fission

In Figure (1) the reactant molecule is characterised by a certain complex trope – an arrangement of electrons and atoms. Each product molecule is characterised by a

[390] Ibid., p.141.

[391] Ibid., pp.127-28. The '*'signifies an unpaired electron

complex trope that, as we can clearly see, derives from the complex trope that formerly characterised the reactant molecule. The structural trope manifested by the ethane has partially persisted throughout the reaction. In this scenario, structural-trope fission and fusion seems to make sense.

Now take this example instead. Imagine a game of cricket during which the bowler delivers the ball down the pitch; and the batsman square cuts the ball for four runs. We want to say that the action of the bat caused the ball to reach the boundary. How will this fact be analysed under persistence theory? This process consists of an unstable fusion of tropes followed by fission. Various tropes manifested by the ball become compresent with others tropes manifested by the bat. The short-lived result is an unstable compound trope consisting of certain 'bat-ish' tropes and certain 'ball-ish' tropes. As this fusion is unstable, some law of nature dictates that it will fission at some time in the not too distant future.[392] What of this unstable complex trope of 'bat-ish' and 'ball-ish' tropes? What has this property? If we subscribe to a substance/attribute account of property instantiation, that bearer will be an unusual object - some kind of bat/ball fusion. It might consist of the bat and ball, or perhaps of only parts of the bat and parts of the ball – I am not sure. Ehring is silent about these kinds of gerrymandered objects and whether we should allow them. However, it does appear that the theory requires such objects if it is to include complex tropes.

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[392] Alternatively, take Ehring's own example. Imagine that I cut a piece of string in half with a pair of scissors. We want to say that the action of the scissors caused the string to be cut in two. The movement/sharpness trope exhibited by the scissors becomes compresent with the structural length-trope exhibited by the string. This structural trope is constituted by two 1/2 length tropes and an 'attached to' relation. When the scissors and string meet, an unstable fusion is formed. The result is an unstable compound trope consisting of the movement/sharpness trope and the structural length-trope. This unstable compound trope then fissions, and results in two 1/2 lengths of string. There has been partial trope persistence in this process, which serves to qualify it as causal. *Causation and Persistence*, pp.124-25.

In the cricket case, we presume that not *all* of the tropes manifested by the bat are causally relevant to the movement of the ball. We tend to think that only some, such as the hardness-trope of the bat, are relevant to others, say the lightness-trope of the ball. However, if we can countenance the existence of a compound hardness/lightness trope, can we not also accept others, say a colour/lightness compound trope? But we just do not think that the fawn of the bat is causally relevant to the flight of the cricket ball. This starts looks like overly promiscuous combinatorialism. That is, it looks like any trope can sensibly fuse with any other. However, in order to avoid this outcome Ehring claims that a colour/lightness trope is not a genuine compound trope in this case. The nomic consequences of these two tropes being 'fused' are no different to the nomic consequences of them remaining separate. On the other hand, the nomic consequences of the hardness-trope fusing with the lightness-trope are very different from the consequences had they remained apart. Under what conditions do two tropes at a time form a compound trope? Put simply, trope a at t_1 and trope b at t_1 form a compound trope just in case there is a relation R between a and b at t_1 such that the (nomic) consequences of Rab and the fact that a and b are both realised, are different from the legal consequences of $\neg Rab$ and a and b.[393]

Here, Ehring makes the retreat into nomological relations. It turns out that although it is the case that causation's *singularist* component is constituted by trope persistence; causation's *generalist* component can only be given by reference to type relations of lawful connection between cause and effect. Fawnness/lightness compound tropes are not genuine because their components are not lawfully connected in the appropriate manner. Causal laws constrain the combinations of tropes that count as genuine compounds. Ultimately, simple property persistence is not enough for

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[393] Ibid., p.123.

causation; only law governed property persistence can do the job.[394] The role of laws

becomes explicit in the formalisation of persistence theory according to which property

P at t_1 causes property Q at t_2 if :

(A) P at t_1 is strongly causally connected to Q at t_2,[395] and P at t_1 is causally prior to Q at

t_2; or

(B) There is a set of properties (R_1, R_n) such that P is a cause of R_1 under clause (A),

and R_n is a cause of Q under clause (A).[396]

Enduring tropes of perduring objects?

Finally, we come to the identity through time, not of tropes but of objects. As has been

seen, Ehring insists that tropes endure. That is, tropes do not persist by way of causal

relations between their temporal parts. However, even though a trope-persistence theory

of causation is incompatible with a causal perdurantist account of trope persistence, it *is*

compatible with a causal perdurantist account of physical-object identity. Recall that on

causal perdurantism about objects, the stages of an object are genidentical if, and only

if, those stages are causally connected. Or, two object-stages s_1 and s_2 are genidentical

only if s_1 (or s_2) causes s_2 (or s_1). On the persistence theory of causation, this will mean

that two object-stages s_1 and s_2 are genidentical only if s_1 (or s_2) contains a property that

is identical, or partially identical to some property contained in s_2 (or s_1). Ehring

concludes that,

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[394] Space does not permit an examination of Ehring's views on the generalist features of causation.

[395] Where 'strong causal connection is understood as: (i) P and Q are lawfully connected; and either (ii) P is identical to Q or some part of Q, or Q is identical to P or some part of P; or (iii) P and Q supervene on tropes P' and Q' which satisfy (i) and (ii). *Causation and Persistence*, p.129.

[396] Ibid., p.130.

... there does not seem to be any circularity or inconsistency in combining a persistence theory of causation with a causal theory of physical-object identity.[397]

In this section, I have developed the persistence theory of causation in some detail. Below, I discuss Ehring's arguments for his view that persisting tropes are the relata of causation. As we will see, he does not provide sufficient reason for accepting persistence theory.

5.3 Persistence theory examined

Ehring argues that tropes exist, and their persistence is what constitutes the causal mechanism. In addition, he claims that only tropes can play the role of causal relata. In order to do this he must first argue that tropes exist. That is, he must show that properties *are* tropes rather than exemplifications of universals. Secondly, he must show that tropes are the kind of thing that can persist. I will now examine his arguments for each of these points.

Tropes versus exemplifications of universals

Let us grant that the relata of causation are property instances. Why should we believe that property instances are tropes rather than exemplifications of universals? We may see properties and relations in one of two ways - as exemplifications of universals or as

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[397] Ibid., p.139-40. Note that the compatibility between enduring tropes and perduring objects will only last if we do not adopt a bundle theory of objects. As Ehring notes, (*Causation and Persistence*, p.171 n.14), "if objects are understood to be bundles of properties with no other constituents, then a nonrelational view of trope persistence would seem to dictate a nonrelational view of object identity. But if objects are not simply collections of their tropes, then there may be room for a relational account of object identity."

individual properties. Ehring subscribes to the latter view – that properties and relations are individuals, and roundnesses and whitenesses are particulars in the same way that balls and pages are. For Ehring properties are particulars and therefore cannot be shared. Tropes cannot characterise more than one wholly distinct object at a time. In other words, tropes of spatially wholly distinct objects at the same time are necessarily non-identical. Tropes are never simultaneously multiply realised, as they are always singly spatially located. An example of a trope might be the whiteness of this page.

Here are several other things to notice about tropes.[398] First, tropes of physical objects are spatiotemporally located. Second, tropes are abstract. 'Abstract' here refers to a distinction between tropes and concrete, or ordinary objects. Tropes are abstract in the sense that they often overlap with each other at the same location. For example, the colour of a sphere will overlap with the shape of the same sphere. However, concrete objects do not overlap with other concrete objects. The sphere itself monopolises its location, and therefore excludes other concrete objects. The possibility of co-occupation makes tropes both non-concrete and abstract. Third, tropes are not 'bare particulars'. Bare particulars are often postulated in order to supply particularity to ordinary objects, that is, to tie the universal properties of an object to some *thing*. Tropes are not bare. They have a nature, because they are themselves properties. Fourth, tropes are not states of affairs. That is, tropes are not exemplifications of universals by an object, or property instances.

On the competing view, a property of an object is a universal that *can* characterise more than one object at the same time. A ball here might exemplify the very same universal 'roundness' as an orange over there – at the same moment in time. What is universal *is* so because it is possible for it to be wholly and completely in more

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[398] Ibid., p.11.

than one spatial position at any given time. Universals run through the many. On this view, a property of an object at a time is an exemplification of a universal. More precisely, a property instance is the exemplification of a universal, (including n-adic relations), by a concrete object, (or n-tuple of objects), at a time. In such a scenario the relata of causation are 'the having of' particularised properties where properties are understood as exemplifications of universals.[399] On the trope view, the relata of causation are the individual properties *themselves*, rather than the '*having* of such and such a property'. Something should be said though about general or universal properties – that is, not this roundness, but roundness in general. On the trope view, 'roundness' is just the class of exactly similar roundnesses.

Ehring maintains that we should see property instances as tropes rather than exemplifications of universals. Here is his argument in support of that view.[400] Imagine that an object is isolated from external causal influences and persists in a state P from t_1 to t_2. What is the cause of state P at t_2? A natural response is to say that the cause of state P at t_2 is P at t_1.[401] Such property persistence, it is claimed, cannot be satisfactorily characterised by the view, according to which property instances are exemplification of universals.

The above 'argument' is puzzling. Surely, Ehring should say that by enduring through time, the self-same, numerically identical trope P is manifested from t_1 to t_2. Instead, he claims that the two tropes are temporally distinct incarnations of the same trope. This actually sounds no different to claiming that P at t_1 and P at t_2 are temporally distinct exemplifications of the same universal. Ehring claims that for

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[399] Ibid., p.115.

[400] Ibid., pp.87-89.

[401] Ehring calls this 'inertial persistence'.

exemplifications of universals to do the work here would mean one of two things. The friend of exemplifications must either: (a) say that the exemplification of P by the object at t_1 is the same as the exemplification of P by the object at t_2; or (b) invoke some relation R that connects the exemplifications of P. But the friend of exemplifications cannot take the first option, (a). For if P at t_1 and P at t_2 are taken to be the same exemplification, this will violate the stricture that exemplifications are necessarily momentary. Exemplifications are supposed to be had by an object at a time, and distinct exemplifications are not identical. If, however, the friend of exemplifications chooses the second option, (b), and posits some relation R, for example - causation, circularity will ensue. This circularity will arise because:

Since we are attempting to give the outlines of a persistence account of the causal connection between the exemplification of P at t_1 and the exemplification of P at t_2, the relation to which appeal is made cannot be causation itself.[402]

Ehring maintains that further specifying the nature of this supposed relation between states will be of no assistance. Probabilistic, nomic, spatiotemporal, and combinations of these relations, will run aground when it comes to the preemption-pairing problem, and therefore cannot be invoked. This is taken as a *prima facie* reason for rejecting the exemplification view of causal relata.[403]

I have this criticism to make of the above argument.[404] If Ehring wants the state P to be a persisting trope rather than an exemplification, then similarly he must either: (a) say that the trope P at t_1 is the same as the trope P at t_2 or, (b) invoke some

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[402] Ibid., p.88.

[403] Ibid.

[404] My criticisms of Ehring's arguments are developed in my 'A Universal By Any Other Name' (conference paper delivered at the Australasian Association for the History and Philosophy of Science and the Social Sciences, (Melbourne, 2001).

relation R that connects these tropes. If Ehring takes the second option (b) he risks circularity and the pairing-problem.[405] So Ehring must be saying (a) that the trope P at t_1 is the same as the trope P at t_2. However, as has been pointed out, on the traditional view of trope-hood, tropes are essentially momentary. We have no good reason at this point to think otherwise, for Ehring has not provided an argument to the effect that tropes can persist. Without an argument to support the persistence of tropes it looks as though the reasons Ehring gives against seeing property instances as exemplifications of universals are also good reasons to think property instances are *not* tropes.[406]

Ehring's idea that tropes endure through time is at odds with an orthodox understanding of tropes. In fact, most friends of tropes hold that tropes are momentary. Take for example Keith Campbell's claim that tropes 'have a local habitation, a single, circumscribed place in space-time.'[407] On this view, tropes are conceived as being individuated by a time, which means that they cannot be wholly present at more than one wholly distinct time, as Ehring requires. On the orthodox view, the charge of an electron at time t_1 is necessarily non-identical to the charge of that same electron at a later time t_2. However, Ehring asks that tropes be capable of persisting, or enduring.

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[405] As he admits, in his *Causation and Persistence*, pp.104-115.

[406] Ehring's worst fears have been realised. He says "Whether this is also a reason for shifting to the trope view is yet undecided. If the trope view runs into the same difficulties with understanding property persistence – relative to a theory of causation that makes use of the notion of property persistence – then we have an equally good reason for rejecting the trope view of causal relata. In fact, these same kinds of difficulties will surface if we analyze property persistence in terms of some relation (other than causation) between trope stages or momentary tropes. Here, however, the trope theorist has an option not open to the exemplification theorist. ... tropes are not essentially momentary and ... there is room for a nonrelational account of trope persistence. With such an account in hand, a persistence theory of causation that makes use of the notion of property persistence will be able to avoid circularity as well as the preemption pairing problem." *Causation and Persistence*, pp.88-9. I agree – this would be a very neat outcome, if only it was persuasively argued for.

[407] Keith Campbell, *Abstract Particulars*, (Oxford: Blackwell, 1990), p.53.

According to Ehring, the charge of an electron at time t_1 is perfectly capable of persisting, and therefore being identical with the charge of that same electron at a later time t_2. Ehring is acutely aware that his view is an unusual one, and requires some kind of defence. Let's grant for the sake of argument that property instances are the relata of causation, and are best understood as tropes rather than exemplifications, as Ehring maintains. Now, why should we believe that tropes persist through time?

The argument from non-salient qualitative change

Here, Ehring offers what he calls the 'argument from non-salient qualitative change'. It is intended to show that only a trope-based account of properties can discriminate between non-salient qualitative change and genuine property persistence. Here is that argument.[408] Imagine a machine that is capable of annihilating all charge from an object, but has no other effect on that object. Imagine a second machine that can instantly generate a charge in objects. Consider these two cases:

Case (1): The two machines are directed toward the same particle and are set to activate at the same time t_2. The first machine annihilates the electrical charge, of magnitude e, of the particle, and at the same instant the second machine generates an electrical charge of magnitude e in the particle. At t_2 the result is that there is no noticeable change in the electrical charge in the particle from t_1 to t_2;

Case (2): The particle undergoes no transformation via any machines, but retains it electrical charge, of magnitude e, over this same time period.

Ehring (rightly) claims that there is a real difference between these cases. We see property persistence in the second case but not in the first. The argument

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[408] For details of this argument see Ehring's *Causation and Persistence*, pp. 94-99.

proceeds with the claim that certain characterisations of properties will fail to distinguish between these cases. Universals are ruled out because in case (1) the particle exemplifies the same (charge) universal, both before and after the activation of the machines.

Similarly, an exemplification of a universal will not do. Ehring argues that exemplifications of universals are simply not the sort of thing that can persist. Such exemplifications always exist at a time. Therefore in case (2), we do not get the required persistence. The exemplification does not persist from t_1 to t_2; rather the exemplification at t_1 is replaced by a distinct exemplification at t_2. Ehring argues that the concept of a persisting exemplification is incoherent, as exemplifications are partly individuated by the time of their realisation.

Could we not say that case (1) involves genuine qualitative persistence because it constituted by a series of causally connected exemplifications of universals, and that case (2) does not because this causal connection is absent?[409] We might say that property P persists in object O from t_1 to t_2 just in case the exemplification of P by O at t_2 is caused by the exemplification of P at t_1. But even if it were the case that an exemplification of a universal could persist through time by being causally connected, it still could not serve to differentiate between the two cases. Such a characterisation turns out to mean that cases (1) and (2) are again indistinguishable. The same object, time and universal appear in both the case of non-salient qualitative change and genuine property persistence. Here is an example, intended to make this point clear. Imagine that the annihilator machine will activate *only if* a charge of magnitude e is present in the object, and the charge-creating machine will activate *only if* the annihilator machine is activated. Now causation is present in the first case, which leads us to the conclusion

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[409]This is the line that David Armstrong would take (personal communication).

that causation cannot make the difference between non-salient qualitative change and qualitative persistence. Couldn't we modify this scenario such that the causation is required to remain within one object, or be immanent? This might make the difference, in that case (1) of non-salient qualitative change does not exhibit internal causal dependence. Ehring replies that we could place the machines inside the objects such that the causal connection is present in both cases.[410]

Perhaps we might say that property P persists in object O from t_1 to t_2 just in case the exemplification of P by O at t_2 is caused by the exemplification of P at O at t_1 by way of a causal chain of an *appropriate* kind.[411] Ehring argues that such appeals to appropriateness are inevitably circular when spelt out. He concludes therefore, that an attempt to demarcate genuine property persistence from non-salient qualitative change in terms of temporally distinct exemplifications of the same universal turns out to be either inadequate or circular. Only persistent tropes can make the difference between non-salient qualitative change and genuine property persistence, or so the argument goes. Ehring concludes that a satisfactory non-tropic characterisation of the difference between these cases cannot be given. For Ehring, the metaphysical fact of qualitative persistence can only be accounted for by enduring tropes.[412]

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[410] A claim which is, in my opinion, highly dubious.

[411] Ehring, *Causation and Persistence,* p.98. See my earlier discussion of the role of appropriateness in casual perdurantism (§3.4).

[412] If Ehring wants to make the difference between non-salient qualitative change and genuine property persistence by way of enduring tropes, surely the anti-trope theorist can simply reply that exemplifications of universals endure through time? The claim would be that there is an enduring exemplification in case (2), but not in case (1). Ehring responds by saying that there is still no difference between case (1) and (2). For, in each case there exists the same exemplification relation (also a universal), object, and universal that are exemplified. As the components remain constant through t_2, nothing will guarantee that we have a persisting exemplification in one case and not in the other.

Given my earlier discussion of the Mechanist Thesis, we know that in order to avoid circularity Ehring must maintain that tropes persist by enduring. Recall the cases outlined above. The difference must lie in the fact that, in case (2) the charge of the particle has endured through time, whereas in case (1) the charge of the particle has been replaced by a non-identical, yet equal charge. If an entity endures, it is wholly present at each of two times. But again, there is no argument for why we should think of tropes as being the kind of things that persist. Such a radical revision of our understanding of trope-hood has not been argued for, but rather stipulated – which is, in my view, unsatisfactory.[413]

5.4 Persistence theory and rotating disc arguments

I have said that according to persistence theory, causation is to be analysed in terms of the endurance of tropes. As Ehring realises, any attempt to analyse the persistence of tropes in terms of causation will be circular. In addition however, Ehring argues that any relational account of trope persistence will be faced with the (Kripke/Armstrong)

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[413] Ehring's example of the charge-annihilator and creator machines is reminiscent of earlier examples discussed in an earlier chapter (§2.5). That discussion concerned 'immaculate replacement' examples. Those examples were intended to show that spatiotemporal continuity is neither necessary nor sufficient for persistence. Furthermore, those cases were about the persistence of objects, rather than the persistence of properties. However, the parallel is clear, and in any case if tropes are particulars in any real sense, what applies to objects should apply to them. In that earlier discussion, I said that Armstrong and Shoemaker supplement spatiotemporal continuity with causation in order to rule out cases in which there is continuity but no identity. Recall that in the spurious cases the causal relations are absent. Ehring, on the other hand, does not have this option. He cannot say that what makes the case of non-salient qualitative change a case of pseudo-persistence is that a certain feature, (namely causal connection between temporal parts of properties) is missing. In fact, Ehring claims that immaculate replacement cases are ultimately cases of non-salient *object* change, (*Causation and Persistence*, p.104). Accordingly, if objects are just bundles properties, immaculate object replacement is just multiple immaculate property replacement, (p172 n.18).

homogenous rotating disc problem. Ehring uses a version of the rotating disc argument

in support of his view that persisting tropes must endure, or be wholly present at every

moment at which they exist. A causal theory of trope persistence faces the problem of

accounting for trope motion, just as a causal theory of object persistence faces the

problem of accounting for object motion. Up until this point, RDA has been discussed

in the context of physical *object* identity through time. It is now appropriate to turn to

RDA in the context of *trope* identity through time.

Perduring tropes and RDA

On a relational theory of trope persistence, a sphere in motion can be discriminated

from a sphere in stasis, because the relevant trope stages have different spatial locations,

and are appropriately related by whatever relations constitute the genidentity of tropes.

However, as we have seen a causal account cannot properly diagnose the facts of trope

persistence and motion in such cases.[414] That is, a causal account of trope persistence

will sometimes fail to track moving tropes, and therefore fail to determine questions of

trope identity.

For Ehring, tropes are spatiotemporal particulars, which can persist and

move. Consider a perfectly homogeneous sphere in an otherwise empty universe. Either

the sphere is rotating or it is stationary. At any moment in its history the sphere's

properties and its relations to other objects at that time will not vary whether or not it is

rotating. RDA was discussed (§3.1) in its capacity to show that an SQC account of

object identity cannot discriminate between rotation and stasis, and hence cannot

determine to which later quadrant stage (the northwestern, or southwestern for

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[414] In his *Causation and Persistence*, p.105, Ehring sees RDA as a variation of the problem of non-salient qualitative change.

instance), the current northwestern quadrant of the sphere is genidentical. I subsequently argued in chapter four that a causal perdurantist account of object identity also falls down in this regard. The causal perdurantist cannot demarcate genuine from pseudo identities, without assuming facts of identity. In other words, the causal perdurantist must render her theory circular in order to avoid RDA. The question now at hand is - can a causal account of trope persistence discriminate between motion and stasis of the tropes that characterise the sphere? Consider a colour trope had by the northwestern quadrant of the sphere. Either the trope is in motion or it is not. For a causal account to succeed, it must somehow differentiate between:

(1) (rotation) The colour trope that characterised the northwestern portion of the sphere at t_1 characterises the southwestern portion at t_2; and

(2) (stasis) The colour trope that characterised the northwestern portion of the sphere at t_1 characterises the northwestern portion at t_2.

We might think that causation can make the difference here, and determine the fact of (non)rotation. The idea of course is that the two possibilities correspond to very different inter-trope-stage causal relations. If the trope is stationary, the colour stages that characterise the northwestern portion of the sphere over time are causally connected in a certain way, but this will not be the case if the trope is in motion. If the colour trope is stationary, the colour stages of the northwestern portion from t_1 to t_2 will bear to each other that particular causal relationship that is required for trope phases to constitute phases of the very same trope. If the colour is rotating, on the other hand, the earlier northwestern colour trope stage will be causally connected in a similar way to the later southwestern colour trope stage.

Ehring argues that this account cannot succeed. His argument against a causal perdurantist account of trope persistence directly parallels the one that I have outlined against a causal account of the identity of objects.[415]

Trope persistence cannot be analyzed relationally. In particular, trope persistence is not a matter of causal relations among temporal parts of tropes. A causal theory that does not make use of a theory of causation will end up being circular. And a causal theory that makes use of one of the leading reductionist theories of causation will be inadequate to the problem of positional nonsalient qualitative change.[416]

Ehring has learnt the lesson of circularity well. He is aware that if he wants to analyse causation in terms of the persistence of some entity, that entity must not persist by way of causal relations between its temporal parts.

Enduring tropes and RDA

Presumably, under an *enduring* trope view we can characterise the relevant states of motion of the homogeneous sphere like so. Rotation and stasis respectively will come out as:

(R) Trope T, which characterises the northwestern portion at t_2, is numerically identical with the trope T, which characterised the southwestern portion at t_1;[417] and

(S) Trope T, which characterises the northwestern portion at t_2, is numerically identical with the trope T, which characterised the northwestern portion at t_1.

The fact that Ehring takes persisting tropes to endure through time means that his theory of causation is not subject to RDA. This should not be surprising. After

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[415] For Ehring's specific arguments against neo-Humean, counterfactual and probabilistic causal perdurantism see his *Causation and Persistence*, pp.106-114.

[416] Ibid., p.114.

[417] Provided that the sphere has made exactly N revolutions, for any whole number N.

all, rotating disc arguments are posed as a threat to perdurantism rather than endurantism. I agree with Ehring – a non-causal account of the persistence of tropes will serve to distinguish states of motion in homogeneous objects. In conclusion, I would go further than Ehring. Just as an endurantist account of the persistence of tropes is the only way to fix the fact of trope motion in RDA contexts, so too an endurantist account of physical object persistence is our only method of fixing the non(motion) of objects or of their parts.

5.5 Persistence theory and the problem of temporary intrinsics

I have said that Ehring wants tropes to persist strictly or to endure. This amounts to a trope persisting, not by way of relations holding between its temporal or spatial parts, but rather by it being wholly present at every moment of its existence. As an endurantist account, this faces the problem of change in temporary intrinsic properties, as outlined in a previous chapter (§1.3) This is a problem for the endurantist whether the persisting entity in question is an object or a property. In this section I will examine the impact of this problem on the thesis that tropes endure through time.

Recall the problem of temporary intrinsics, or change. The question is - how can an object be self-identical at two different times if it possesses different intrinsic properties at those times?[418] How can an object O be F at t_1 and yet lack F (or be G, where F and G are contrary properties), at t_2, though that same object is wholly present at both times?

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[418] Recall also that intrinsic properties hold independently of what is the case elsewhere and elsewhen, or independently of facts about other regions that have no causal influence on that object. A temporary intrinsic property is an intrinsic property that characterises an object during only part of that object's history. Extrinsic properties, on the other hand, are instantiated by individuals because of the relations they bear to other things.

Do tropes have temporary intrinsic properties? We can easily imagine that they do. Take the orange trope exemplified by a particular basketball at a particular time, t_1. We can imagine this trope persisting unchanged through some interval $t_1 - t_2$. Does this trope have properties? We might say that yes, the orange-trope of the ball has a certain shape trope '*sph*'. The orange trope is spherical, and has a certain magnitude. The shape of the orange-trope is intrinsic to that trope, and is temporary. Clearly, this *sph* can change. For example, if over time the ball loses internal air pressure the magnitude of *sph* will decrease over time. If what I have said is correct, then enduring tropes have temporary intrinsics. But how can the enduring colour-trope, exemplified by the ball have *sph* at t_1, and not have *sph* at t_2, if the colour-trope at t_1 and colour-trope at t_2 are strictly identical throughout the interval $t_1 - t_2$. It seems that enduring tropes do face the problem of temporary intrinsics.

One reply might be to say during the interval $t_1 - t_2$ there does not exist one colour-trope that has *sph*, and then does not have *sph*. Rather, during the interval, there exists a series of distinct colour-tropes that have a series of different, but not contradictory shape-tropes. This will require some account of the individuation of colour-tropes – where one finishes and another begins, so to speak. Just what provides this individuation is a mystery. Tropes are not individuated by the objects that have them, for on this defence a series of distinct colour-tropes are manifested by one persisting ball. Spatial location will not do, because the position of the ball, and therefore, the position of the colour-trope has not changed throughout the interval $t_1 - t_2$.

A better response is to say that, in fact, tropes do not have temporary intrinsic properties such as shape. One way to argue for this would be to say that tropes lack spatial extension. Are tropes extended in space? Imagine a trope, say, the whiteness of this page. Is this trope a spatially extended property, which fills the same region as

the page? This reflects ordinary trope-talk, for we do talk about 'the redness of that ball', or the 'fawn trope exemplified by that cricket bat'. We seem to be referring to tropes that are smeared out across the region that a certain complex object takes up. Or perhaps we mean something different. Perhaps when we say 'the whiteness of this page' we are referring to a collection of smaller tropes had by those fundamental objects that are constitutive of the piece of paper. On such a view, there are as many whiteness tropes as there are white objects. Alternatively, we might think that there are two 'sizes' of trope exhibited by the page, say the 'bigger' whiteness trope that is had by the extended page, and many 'smaller' whiteness tropes that are exhibited by the spatial parts of the page. This has a bearing on the problem of temporary intrinsics. If tropes are extended in space, and take up regions rather than points, they will have temporary intrinsic properties such as shape.

Ehring's own examples of trope fission, fusion and persistence suggest that he holds the first view. He thinks that tropes have spatial extension and are exemplified by objects like pages, balls and bats. For Ehring, enduring tropes do have spatial extension; therefore tropes have temporary intrinsic properties. And I would argue that as enduring tropes have temporary intrinsic properties, some account must be given of the fact that these temporary intrinsics can change.

5.6 Persistence theory and the Russell-minus objection

Similarly, enduring tropes will have to account for the problem of changes in parts, also introduced towards the end of chapter one (§1.5). This was a challenge to the endurantism of things that have spatial parts, and will apply to any enduring entity that

has spatial extent. As I have argued, for Ehring tropes are extended in this way.[419] Can

we assume then, that the colour-trope exemplified by the basketball has spatial parts? If

it has extension, then it has such parts.[420]

Recall the problem of change in parts for enduring objects.[421] I want to now

apply that problem to the parts of enduring properties. Consider the whiteness of this

page, or 'White', as it was at a certain time, t. Before t White was fully intact, and had a

left corner. Call this trope 'White-before- t'. We can assume that if White existed before

t, then so did something else, which we can call 'White-minus'. This earlier trope,

White-minus, consists of all of White, except its left corner. 'White minus-before t' is

the name that we give to the trope which is White-minus as it existed before t. We now

assume that at t, White loses its left corner. We call this trope 'White-after- t'. Now, we

believe that a thing can survive the loss of some of its parts. If White endures; (1)

White-before- t is numerically identical with White-after- t. But we know that White

and White-minus both survive the loss of the said left corner. Furthermore, we believe

this to be the case despite the fact that White's left corner is not attached to White-

minus. An endurantist about tropes, Ehring should interpret the survival of White-minus

as a case of strict numerical identity. That is, he should maintain that White-minus-

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[419] In fact Ehring's theory of causation *requires* that enduring tropes have spatial parts. The account of partial trope persistence is given in terms of trope fission, and as such requires that tropes have parts, into which they *can* fission. The point of partial trope persistence just is that *part* of the original trope remains after fission, or fusion.

[420] Although, according to Parsons and Marksonian, something might extend through space without having parts. Parsons calls this 'entending' through space. Marksonian adds that such entities must be maximally continuous in space in order to entend. I argue elsewhere that Parson's argument for the entension of simples relies on an equivocation over the mereological and physical senses of 'simple'. For details, see my 'How to Endure', (Joint paper with Stephen Barker and Phil Dowe, delivered at the University of Tasmania Philosophy Seminar series, 2001).

[421] For the original formulation of this objection to endurantism see chapter one (§1.5).

after-t is numerically identical with White-minus as it exists after the loss of its left

corner. So, as an endurantist, Ehring is also committed to the claim that; (2) White-

minus-after- t is numerically identical with White-minus-before- t. But now Ehring is

committed to the existence of two tropes, namely White-after-t and White-minus-after-

t. How is the relation between these two tropes to be characterised? To begin with, they

clearly occupy the same region of spacetime, and they are exemplified by exactly the

same matter, namely the page. So, White-after-t and White-minus after-t are part for

part identical.[422] This then, commits the endurantist to the third claim that; (3) White-

after- t is numerically identical with White-minus-after- t. Given the transitivity of

identity, we get the argument that:

(1) White-before- t is numerically identical with White-after- t;

(2) White-minus-after- t is numerically identical with White-minus-before- t; and

(3) White-after- t is numerically identical with White-minus-after- t.

Therefore (4) White-before- t is numerically identical with White-minus-before- t.

But White-before- t has a left corner and White-minus-before- t does not. How can the

two tropes be identical if they are not indiscernible? The two tropes have different

shapes, mass and are exemplified in different regions of space. Given (4), the

endurantist is committed to the contradictory statement; (5) White-before-t is not

numerically identical with White-minus-before-t.

Ehring has two choices here. He can take up this challenge, (perhaps by

recourse to some kind of essentialism), or he can deny that enduring tropes have spatial

parts. He does neither. Therefore, the argument for the persistence, and endurance of

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[422] Presuming that the argument that tropes have spatial parts goes through.

tropes has not been shown to overcome the problem of temporary intrinsics or the problem of changes in parts.[423]

Nevertheless Ehring may have pointed the way towards a satisfactory resolution of these problems, even if he has not presented one. His account solves rotating disc arguments because it is not perdurantist. However, in being endurantist it faces the problem of temporary intrinsics and that of changes in parts. The account fails to avoid these latter problems because the enduring entity in question is seen as having spatial extent, and temporary intrinsics. What is needed then is some enduring entity that has neither spatial extent, not temporary intrinsics. Such an entity will be unextended and mereologically simple. Also it will not admit of change to its intrinsic properties. In the following chapter I will argue that such an entity can be found in Leibniz's *Monadology*.

5.7 Summary

In this chapter I began by outlining the persistence theory of causation as characterised by the Mechanist Thesis. I pointed out that this theory is not circular in the sense that it does not invoke a causal perdurantist account of the entities that transmit causal influence. RDA does look like a good reason for thinking that persisting tropes, if there are such, endure rather than perdure. However, I have also argued that we have not been given any good reasons to think that property instances are tropes rather than exemplifications of universals, or that tropes are not momentary. I also argued that even if we grant that tropes do endure through time, this will only yield a solution to the

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[423] I suspect there may be another issue involved here, one involving logical parts. Do tropes have logical parts? It seems that they might, but space does not permit an examination of this claim. For more on logical parts see Laurie Paul's *Logical Parts*, (circulated manuscript).

problem of temporary intrinsics if those tropes are conceived of as not having spatial

extension. I conclude that the theory is not supportable, and cannot make good on its

claims.

Chapter 6: Causal endurantism: a new account

In the previous chapter I outlined a view according to which properties are seen as enduring tropes. I said there that although this view is not confronted by rotating disc arguments, it cannot overcome the problems of change in temporary intrinsics, and changes in parts. I argued that this was due to the fact that there is a genuine sense in which the tropes in question have spatial extension. In this chapter I want to consider entities that have no such extension. I will argue that these entities, Leibnizian monads, can avoid RDA, and the problems of temporary intrinsic and changes in parts. What we come to is a satisfactory non-causal account of identity, but as I will point out, this comes at the cost of some fairly radical metaphysical claims. However, I will maintain that we can exploit this solution without believing in the existence of non-physical simples. An examination of Leibnizian identity leads us to a new account of identity through time – 'causal endurantism'.[424]

This chapter proceeds in this manner. In the first section (§6.1) I will show that, contrary to the opinion of some, there is more to monadic persistence than the enumeration of that monad's complete concept. I will also outline a causal perdurantist interpretation of Leibniz on monadic identity. I will then give two arguments against this interpretation and will instead argue that, for Leibniz, monadic identity through time is a matter of strict endurance (§6.2). It should be noted that the argument of this thesis does not turn on this being the correct interpretation of Leibniz. The interpretative discussion simply assists to motivate and clarify the new account of persistence – causal endurantism – that is defended. In (§6.3) I formulate this new account, based on Leibnizian endurance. As will be seen, this account of identity is well placed to avoid

the shortcomings of both conventional endurance and causal perdurance. I will show just how this view can accommodate RDA, and avoid the problem of temporary intrinsics and the problem of changes in parts. Finally I will argue that causal endurantism in no way commits us to non-physicalism. I will show that although Leibniz is committed to the non-extension of his fundamental simples, we need not be. This is due to the fact that the advantages of causal endurantism arise, not because the entity in question lacks spatial and temporal parts, but because its states are caused by a dispositional property that is invariant and enduring.

6.1 An interpretative interlude

The role of the complete concept

Leibniz argues for a conceptual containment theory of truth.[425] That is, he holds the '*in esse*' principle. This is the principle that every substance has a complete concept that

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[424] This is not the happiest of terms. However, until a better label presents itself the name will suffice as it captures the sense in which the new account is endurantist and yet is also, in a real sense, perdurantist.

[425] Note that this discussion is restricted to Leibniz's later ontology. That is to say, it is concerned with Leibniz's views about identity during the monadological period. I do this because later in his career Leibniz concludes that all phenomena result from the activity of truly simple substances, or monads. Accordingly, I will only be concerned here with the identity through time of those genuine created simples. Leibniz does discuss the identity through time of aggregate objects, especially in the earlier writings, and there is, of course, an analysis of the relation between the persistence of monads and the persistence of aggregate objects. However, space does not permit a discussion of this analysis. For good accounts of the relation between individual substances and bodies as phenomena in Leibniz see: Anthony Saville's, 'Leibniz, composite substances and the persistence of living things' (circulated manuscript); Robert Adams', 'Phenomenalism and Corporeal Substance in Leibniz', in *Midwest Studies in Philosophy vol 8*, French, et al, (eds) (Minneapolis: University of Minnesota Press, 1983) pp.217-255; Kenneth Clatterbaugh's 'Leibniz's Doctrine of Individual Accidents', *Studia Leibnitiana*, Sonderheft 4 (Weisbaden: Franz Steiner Verlag, 1973), pp.1-92, and Miller's 'Leibniz on the Interaction of Bodies', *History of Philosophy Quarterly* 5 (1988) pp.245-254. A hint to this analysis is found in the passage "This principle of action is most intelligible, because there is something in it analogous to what is in us,

contains everything that is true of it. Putting it another way we can say that predicates are contained in their subjects. For Leibniz, each substance, (in this case, each monad), possesses a unique and complete concept. This complete concept contains everything that ever was, is, or will be true of that substance.

We might think that complete concepts provide the key to understanding the identity through time of simples in Leibnizian thought.[426] Taking an aggregate object as an example, say, this page, we might say that conceptual containment will tell us how it is that the page persists. The persistence of the page might reside in nothing more than the fact that the predicates 'was manufactured in 1999' and 'is now being read' are predicates of the one piece of paper. According to this 'conceptual unfolding'

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namely perception and appetition. For the nature of things is uniform, and our nature cannot differ infinitely from other simple substances of which the whole universe consists." (G 2: 270, *Letter to De Volder* 1704). For Leibniz, the page is a *phenomena bene fundata* or well-founded phenomena. It is not a genuine substance, but has its being derivatively from the action of genuine substances or monads. I will not enter into an extended discussion of the nature of individual substances. I take them as they are found in the *Monadology*. That is, as indivisible, unextended, shapeless, ingenerable, incorruptible, 'windowless', unitary, infinite in number, non-spatial, spontaneous, unique, and continually changing. Monads continually change in their degree of distinctness of their perception of all other monads. For our purposes, the important point to remember about Leibnizian monads is that they are active. Each monad perceives every other, to varying degrees of distinctness. Or, "A created thing is said to act outwardly in so far as it has perfection, and to suffer [or be passive, *patir*] in relation to another, in so far as it is imperfect. Thus activity [action] is attributed to a Monad, in so far as it has distinct perceptions, and passivity [passion] in so far as its perceptions are confused." (Theod. 32, 66, 386.).

[426] This is the view of amongst others: Nicholas Rescher, *Leibniz's Metaphysics of Nature* (Dordrecht: Reidel, 1981); R.S Woolhouse 'Leibniz and the Temporal Persistence of Substances', in G.R.H Parkinson (ed), *Truth, Knowledge and Reality: Inquires into the Foundation of Seventeenth Century Rationalism, A Symposium of the Leibniz-Gesellschaft Reading*, 27-30 July 1979, (Weisbaden: Franz Steiner Verlag, 1981): *Studia Leibnitiana* Sonderheft 9, pp. 84-96. See also, Wilfred Sellars' 'Meditationes Leibiniziennes', in *Leibniz: Metaphysics and Philosophy of Science* (Oxford: Oxford University Press, 1981), p.p 30-54.

interpretation of monadic identity,[427] in order to understand what it is for something to persist through time we must first understand what it is for both past and present tensed predicates to be truly ascribed to the same substance. An account of the persistence of monads, based in the complete concept (CC) might look like this:

(CC) Monad x at time t_1, in perceptual state p, is numerically identical with monad y at time t_2, in perceptual state q, if and only if there exists a complete, individual concept which is intrinsic and common to both x and y.

Objection: miraculous action

Although it is suggested by several Leibnizian passages,[428] the conceptual unfolding interpretation cannot be correct. I would rather say that this concept, although not irrelevant to questions identity, does not explain that identity. It is not that thing in which identity consists. For that, we need to understand what a complete concept

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[427] In this terminology I follow Marc Bobro & Kenneth Clatterbaugh 'Unpacking the Monad: Leibniz's Theory of Causality', *The Monist*, 79 (1996) pp. 408-425.

[428] The works of Leibniz are cited by the following abbreviations: AG = *G. W Leibniz Philosophical Essays* ed. and trans. Roger Ariew & Daniel Garber (Indianapolis, IN: Hackett, 1989); G = *Die Philosophischen Shriften von Gottfried Wilhelm Leibniz*, ed. C.I Gerhardt (Berlin: Wedmannsche Buchhandlung, 1875-1890), cited by volume and page; L = *Leibniz, Philosophical Papers and Letters* 2nd edition, ed. and trans. Leroy. E Loemaker, (Dordrecht and Boston: Reidel, 1969); NE = *G. W Leibniz New Essays on Human Understanding*, ed. and trans. Peter Remnant and Jonathan Bennett (Cambridge: Cambridge University Press, 1989); PM = *Philosophical Writings*, ed. and trans. Mary Morris and G.H.R Parkinson (London: Dent [Everyman's Library], 1973).

Textural support for the complete concept analysis abounds. For instance; "... What happens to each [particular substance] is solely a consequence of its complete idea or notion alone, since this idea already contains all its predicates or events. ..." (AG 47, /GP iv, 440), and "These things [events] only seem to us to be undetermined because the foreshadowing or marks which are there in our substance are not recognisable by us. ... In fact, in considering the notion that I have of every true proposition, I find that every predicate, necessary or contingent, past, present, or future, is contained in the notion of the subject; and I ask no more." (PM 59-60 / GP, ii 45)

contains or ranges over. In addition, a major difficulty arises if we interpret Leibniz as asserting that monadic identity is grounded in conceptual containment alone.

The conceptual unfolding interpretation cannot account for the extraordinary operations of God. The problem is this – if every state of the monad occurs due to the unfolding of that monad's complete concept, what are we to say about a monadic state that is produced by God through His miraculous action? Is such a state in accordance with that monad's concept? We can put the problem in the form of a dilemma. If the miraculous state is in accordance with the monad's complete concept, then it is not miraculous, since it is produced by the monad itself, rather than by God. On the other hand, if the miraculous state is not contained in the monad's concept, then in an important sense, that concept cannot be said to be complete. Therefore, the conceptual unfolding interpretation leads to difficulties when it comes to drawing a distinction between the miraculous and natural states of a substance. It seems that a miracle will disrupt a monad's identity. So, in performing a miracle, God is actually creating a new substance. But it must certainly be the case that God *can* perform such miracles, for Leibniz is careful to not compromise God's omnipotence. Leibniz recognises this problem, as is made clear by his asking,

… how is it possible for God sometimes to influence men or other substances by an extraordinary or miraculous occurrence, since it seems that nothing extraordinary or supernatural can happen to them, given that all their events are only consequences of their nature.[429]

This is not to say that Leibniz does not hold the doctrine of the complete concept. But just that concept is not part of the individual and therefore cannot provide a metaphysical account of the conditions under which monad x is identical with monad y. Contemplation of the complete concepts of individual substances forces us to see that

concepts alone cannot ground monadic identity. This is because monads are not concepts. They are for Leibniz the only genuine substances. Monads are, however, characterised by complete concepts and these concepts capture the real attributes that monads actually possess. So, it looks like complete concepts, and the principle of conceptual containment cannot provide the grounding of monadic persistence. Perhaps what we need here is to focus on the fact that monads continually change in their degree of perceptual distinctness.

A perdurantist interpretation

We might think that the seat of monadic persistence lies in the fact that they continually change in their perceptions of other simples. On this view, (EP), causally efficacious perceptions ground monadic identity through time. This is a causal perdurantist interpretation. It is the view that causal relations between successive perceptions of the monad are the ground of monadic persistence. We can represent the causally efficacious interpretation like so.
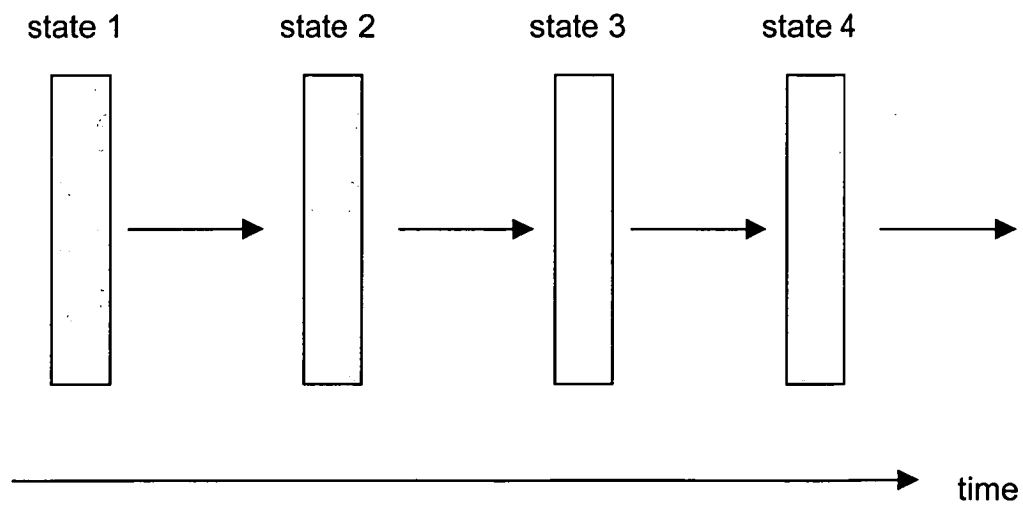

Figure (2) Efficacious perceptions: a perdurance model

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[429]PM 28

Figure 2 represents the view that each successive state is the cause of the next. Such a view is causal and perdurantist because it sees the seat of identity through time as those causal connections between successive states of monads. I will give two objections to this interpretation. The first is that a perdurantist interpretation also runs counter to Leibniz's account of miraculous action. The second objection is that the perdurantist interpretation leads to a causal dilemma.

We can call this the 'efficacious perceptions' account.[430] According to this interpretation of monadic persistence the cause of each perceptual state of the monad is to be found in the previous perception of that monad. This is taken to mean that the persistence of monads has, as its foundation, a causal relation between the successive states or perceptions of the monad. There are several texts in which such an interpretation is at least suggested by Leibniz. Take for example the comment that; "Every present state of a substance occurs to it spontaneously and is only a consequence of its preceding state."[431] On this view it is the causal action of perceptions that provides a criteria for the identity through time of monads. Or more formally:

(EP) Monad x at time t_1, in perceptual state p, is numerically identical with monad y at time t_2, in perceptual state q, if and only if q is a causal antecedent of p.

This interpretation is attractive. First, there must be *some* cause for each perceptual change in a monad. Leibniz is committed to this. The commitment to some cause of perceptual change comes in his 'Principle of Determination', according to which "It is in the nature of created substance to change continually following a certain order which

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[430] I borrow this terminology from Bobro & Clatterbaugh ('Unpacking the Monad'), who attributed this view to Sleigh and Kulstad. I would also place Loeb in this camp.

leads it spontaneously ... through all the sates which it encounters."[432] Every natural, non-initial perception of a monad is said to be caused by that monad's own prior perceptions. We should conclude from this, it is claimed, that the identity through time of the monad is grounded in the action of causally efficacious monadic perceptions. Or that:

Every non-initial, non-miraculous state of every created substance has as a real cause some preceding state of that very substance.[433]

Another advantage for the efficacious perceptions interpretation is that it links monadic identity with Leibniz's thinking about causal laws. Causal relations between perceptions or stages of the monad are said to unfold according to laws that inhere within the monad. Leibniz *does* think that each substance contains in its nature the 'law by which the series of its operations continues'. This 'law of the series' governs the succession of perceptual change. The efficacious perceptions account sees these laws as ranging over the actual succession from perceptual state to perceptual state. This may be one reason why those who hold this view conclude it is perceptions that are responsible for identity. Note also that, according to this view, the law of the series turns out to be a causal law. So, according to this account of monadic persistence the states that make up the history of an individual substance are generated by a relation of genuine causation, applied to its initial state.[434] Note that it is important that this

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[431] GP ii, 47.

[432] L 493/ GP iv 518.

[433] Robert C. Sleigh, *Leibniz and Arnauld: A Commentary on their Correspondence*, (USA: Yale University Press, 1990), p.162.

[434] Sleigh claims textural support is to be found at Discourses 14, 16, 32, 33. See also L 47, 57, 69, 75, 115, 136 and PM 79.

causation be genuine and not merely apparent. Perceptions are said to be genuinely

efficacious, and not merely concomitant.

But is the law of the series a causal law? I do not think so. The 'law of the

series' within the monad, is not strictly speaking, a causal law. It does not express some

causal connection between perceptions.[435] The law of the series expresses Leibniz's

commitment to continuity of perceptual change, but that is not enough for monadic

identity. To understand the role of laws, we need to know what those laws range over.

In addition, this view takes a certain standpoint on Leibniz's doctrine of spontaneity or

the doctrine that "Every present state of a substance occurs to it spontaneously and is

only a consequence of its preceding state."[436] This account relies on a causal

interpretation of the doctrine of spontaneity. On the efficacious perceptions account 'is a

consequence of' is taken to mean 'has as a real cause'. That is, something is an

individual substance only if a relation of real causation applied to its first state generates

its subsequent states. Such an interpretation requires that we ignore the fact that Leibniz

never explicitly uses causal language in formulating the thesis of spontaneity. In fact,

the language in which the principle of spontaneity is formulated is not causal, just as the

language used to formulate the doctrine of the complete concept is not causal.[437] The

doctrine of spontaneity is not introduced in order to express a certain notion of

causality. On the efficacious perceptions view, spontaneity is taken to mean that every

natural, non-initial perception of a monad is caused by that monad's own prior

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[435] As others have said, "… when Leibniz claims that perceptions follow other perceptions he means both that they follow them in time and that they share some content so that they are not radically dissimilar." (Bobro & Clatterbaugh 'Unpacking the Monad'), p.415. This view is also expressed by Clatterbaugh in his 'Leibniz's Doctrine of Individual Accidents', p.25.

[436] GP ii, 47.

[437] For an example, see AG 33, 47.

perceptions. However, rather than being a causal statement, the doctrine of spontaneity refers to the nature of successive perceptions. It ensures the continuity of content within the perceptions of the monad and serves to rule out those 'leaps' or discontinuous changes that Leibniz so wants to avoid. But that does not entail a causal account of monadic identity.

Nevertheless, the efficacious perceptions account certainly does provide an explanation of the cause of the perceptions of the monad, and by the Principle of Sufficient Reason these perceptions must have a reason why they are a certain way and not otherwise. This reason cannot be external to the monad, as Leibniz denies inter-substantial causation, or causation between individual substances. An obvious candidate then, is the prior states of the monad in question. This sort of causal or perdurantist view has an advantage in that it grounds the monad's identity in something within the monad – the causal connections between perceptions. All causation, for Leibniz is immanent, or intra-substantial, and this interpretation puts that causation right where it ought to be.

Objection: miraculous action

However this is not the correct interpretation of Leibnizian identity. I will now point to two serious problems, which confront this sort of interpretation.[438] First, this kind of causal account cannot account for miraculous states of a substance. A miraculous state produced by God will not fit the above criteria of identity. Robert C. Sleigh, a proponent of this view, recognises this problem when he asks that we:

Take some (noninitial) state S' of some created substance x at time t', where x's being in a state S' at t' is miraculous. The natural interpretation of Leibniz's remarks in our period has this consequence; x's being in a state S' at t' is not a causal consequence of some prior state S of substance x; rather it is a causal

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[438] Sleigh formalises his account as "…. Substance x at t = substance y at t' [t' later than t] if and only if, for some states S and S', x is in state S at t and y is in state S' at t' and S is a causal ancestor of S'." *Leibniz and Arnauld*, p.134.

consequence of God's transeunt operation in the miraculous mode. Does this have the unfortunate consequence that miraculous intervention would "disrupt" a substance's identity over time?[439]

If we take some (noninitial) perception of a monad at a certain time, where the fact that the monad is in that state is miraculous, this must mean that the fact that the monad is in that state, is not a causal consequence of some prior state of that monad. Rather, it is a causal consequence of God's transeunt operation in the miraculous mode. So, does a miraculous intervention 'disrupt' a substance's identity over time? This would certainly seem to be the case. It looks like the efficacious perceptions view precludes monadic identity in the event of a miracle. However, Sleigh has a reply at this point. He answers the above question with:

No, since our recommended analysis of the identity of a created substance over time only requires that *some* state of *x* at *t'* have as causal ancestor *some* state of x at t.[440]

Sleigh replies that his analysis of the identity of a created substance over time only requires that *some* state of the monad at a certain time have as a causal ancestor *some* state of the monad at an earlier time. However, this kind of modification will not do the work that Sleigh requires. Although the efficacious perceptions account does fare better in respect to miracles than the conceptual unfolding account, in doing so, it imposes an arbitrary limit on God's extraordinary concourse. Here is an explanation of that limitation.

[This view] precludes God from a miraculous creation in which *each* perception at a temporal slice is causally disconnected from any previous slice. But surely if God is free to impose miraculous states in monads, God should be free to do precisely what Sleigh denies is possible without destroying monadic identity. ... Sleigh's criteria require that although God is free miraculously to transform *any* perceptual

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[439] Ibid., p.135.
[440] Ibid.

state of a monad at t, God is not free miraculously to transform *all* perceptual states of a monad at t. It is a strange and arbitrary restriction on God ... it is a restriction that Leibniz nowhere imposes.[441]

Sleigh attempts to overcome the problem of miracles by modifying his criteria of identity from all perceptions having to have as a real cause a past perception of that monad, to merely some perceptions. This is intended to allow for miraculous action, whilst preserving identity. Instead, we have a situation in which God can only perform miracles if he does not alter *all* of the natural states of a substance. Here we have a clear example of an arbitrary limitation on omnipotence.

Objection: a causal dilemma

Secondly, I would make the objection that this account of Leibnizian identity leads to an anachronistic treatment of causation. I will put this objection in terms of a dilemma. We can ask – If causation between successive perceptions is the basis of monadic identity, what sort of causation is involved in this identity? Take two alternatives, say Humean and non-Humean causation. I would say that both of these theories of causation, applied to a causal theory of Leibnizian identity are anachronistic, and are at odds with Leibniz's metaphysics. Take the first horn of the dilemma, according to which causation between monadic perceptions is Humean, or regularity based. Then the requisite causation is best construed as being a matter of constant conjunction. Successive perceptions are ordered in regular succession and are of a like type.

However, this is not the kind of causation Leibniz wants. Leibniz places genuine, (as opposed to apparent), causation within the monad. All genuine causation is immanent, or intra-substantial. The last thing that is needed, is Humean causation between perceptions. Throughout his mature writings, Leibniz prefers to posit an 'active force inherent in thing', an 'inherent force' (*vis*), a 'nature' (*natura*), or a 'spontaneity'

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[441] Bobro & Clatterbaugh, 'Unpacking the Monad', p.420.

(*autarakeia*) that is causally responsible for change. Leibniz prefers to contrast this view of causation with both that of the Cartesians who, in his opinion, fail to give powers to things and that of Malebranche who gives power only to God. Leibniz prefers to speak of "the operations of things, that follow the laws which God had given them, and which he has enabled them to follow by their natural powers, though not without his assistance."[442] The Humean version of the efficacious perception view is at odds with this aspect of Leibniz's metaphysics. This is because Leibniz, unlike Hume, believes in genuine powers in nature. Simply stated, as causes are active agents, and only substances can be active agents, only substances can be causes, (or rather, perceptions cannot be causes).[443] Perceptions of monads are events, not substances. So, perceptions cannot be causally efficacious – prior perceptions cannot be causes of subsequent perceptions. This has the consequence that individual perceptions are not causally efficacious and are not the basis of monadic identity through time.

The other horn of this dilemma is this. Let us say the type of causation that links perceptions such that they are attributable to one, unified monad is non-Humean. This would certainly place genuine causation within the monad – a definite advantage. However, there are also problems for this interpretation. Such an interpretation faces two dangers. The first is that it will mean that Leibniz will lose the immanent/transeunt distinction. Immanent causation is intra-substantial, and occurs within the monad. Transeunt causation is inter-substantial causation. Leibniz explicitly vetoes causation as occurring between substances. This scholastic distinction between immanent and transeunt causation is used as the basis of Leibniz's claim that transeunt or inter-substantial causation is restricted to God's operations. Now, if genuine causation were

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[442] AG 344.

[443] Bobro & Clatterbaugh, 'Unpacking the Monad', p.416.

to occur at the perception-to-perception level, I would maintain that this causation is in danger of appearing inter-substantial, or between substances – something Leibniz just does not accept. For example:

51. But in simple substances the influence of one Monad upon another is *ideal* only; it can have its effect only through the intervention of God, inasmuch as in the ideas of God a Monad rightly demands that God, in regulating the rest from the beginning of things, should have regard to itself. For since it is impossible for a created Monad to have a physical influence on the inner nature of another, this is the only way in which one can be dependent on the other.[444]

Recall that the efficacious perceptions view is causal and perdurantist. It locates monadic identity in the causal relations between successive perceptual states of the substance. These states are entirely distinct on this account. Perdurantism invariably treats spatial and temporal parts as robust individuals in order to render them causally efficacious. However, it is clear that perceptions are not substances in their own right for Leibniz. For if they were, causation between them would turn out to be inter-substantial and transeunt. The efficacious perceptions interpretation must include some significant distinction between monads and monad-stages. Some explanation must be given as to why, (if monadic identity is a matter of causal relations between monad-stages), such causation remains immanent rather than transeunt. To put it another way, a perdurantist interpretation requires that perceptions, or monad-stages are reified such that they a capable of causal action. However, this will raise stages to the status of individual substances. However, for Leibniz, perceptions are merely accidents of substances, rather than substances themselves.

Just to recap, the efficacious perceptions view faces a causal dilemma. If the identity through time of the monad is to be grounded in causal relations between

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[444]PM 187.

individual perceptions, we must specify just in what this causation consists. If this causation is Humean, the distinction between genuine and apparent causation will be lost. If, on the other hand, that causation is non-Humean, the distinction between immanent and transeunt causation will be lost. Therefore, Sleigh's interpretation is at odds with some of the central tenets of the Leibnizian system. In addition, we should bear in mind the argument given in chapter four. I argued there that causal perdurantism cannot resolve rotating disc arguments. If Leibniz does think that monadic identity is causal, his account will face just the same problem. Recall, the argument was that unless causal perdurantism invokes either facts of motion, or facts identity (and thereby becomes circular), it cannot differentiate between states of motion and stasis in homogeneous objects (as promised).

In addition, Leibniz would not accept this kind of fragmentation of the monad. Individual perceptions of monads are not temporal parts of monads. As genuine simples monads have no parts, and this should include temporal parts. For:

Since actuals are simple, individual substances, they are presumably indivisible in all dimensions. So that simple actuals can be neither composable nor resolvable nor divisible. Such, for Leibniz are true unities.[445]

The efficacious perceptions view requires that monads have temporal parts, and this means that the simplicity and unity of the monads is lost. For this and the reasons outlined above the efficacious perceptions account of monadic identity through time is at odds with Leibniz's metaphysical system.[446] As I have argued, assigning a causal role

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[445] McGuire, ''Labrynthus Continui': Leibniz on Substance, Activity and Matter', in Machamer & Turnbull (eds), *Motion and Time, Space and Matter*, (USA: Ohio State University Press, 1976), p.310.

[446] However, it is not surprising that this mistake has been made. The reason for that mistake is that in order to explain the successive states of a monad, all we need do is look to the previous states of that same monad. That is, "It [primitive active force] is the ultimate metaphysical cause for the series within

to perceptions themselves is untenable. However, this is not to say that there is no

causation within the monad. The monad's enduring active force, I will argue, is causally

efficacious and responsible for perceptual change.[447]

6.2 Leibnizian endurantism

Leibniz holds a view according to which monads are commensurate with an enduring

primitive active force. On this view, the persistence of the monad is grounded in an

enduring disposition towards change. I will argue that this fits in with Leibniz's

thinking about miraculous action and the doctrine of spontaneity. Second, I will show

just how well placed this position is when it comes to avoiding the challenges I

presented to endurantism in chapter one. These problems – the problem of change in

temporary intrinsic properties, and the problem of changes in parts – are avoided by an

account of identity through time that rests in the endurance of fundamental simples.

I have argued that the conceptual unfolding account of monadic persistence

is inadequate. This is partly because, as the name suggests, it is just too conceptual. If

we are looking for that in which monadic persistence consists; we must first discover

what the complete concept refers to. We know that a monad's complete concept

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each monad as well as for each member of the series. If one wishes to predict which members of the
series will come next, one needs to examine the previous members. The continuity of perceptions within
the monad is a better *a posteriori* guide to adjacent perceptions than the primitive active force. This
epistemological role may be why Sleigh, Kulstad, and others have been tempted to assign a causal role to
the perceptions themselves." (Bobro & Clatterbaugh, 'Unpacking the Monad', p.422).

[447] To be fair, friends of the efficacious perceptions account do, to a certain extent recognise the role of
force. It is, of course, recognised that an individual's primitive active force is the 'internal generator'
which allows the substance to produce its states according to its developmental law. Of course, the
efficacious perceptions account cannot ignore the role of primitive forces. After all, in order to be a
substance, an entity must possess a primitive active force. But surely then, the intuitive route is to see that
force as the foundation of monadic change and identity.

includes all of the predicates that are, have been, or will be true of that substance. However, more is referred to. The hint to this is found when, after discussing the need for an *a priori* ground of his own identity, Leibniz goes on to say:

And since, from the time I began to be, it could be said truly about me that this or that would happen to me, it must be acknowledged that these predicates were laws included in the subject or in my complete concept which makes what is called me, which is the foundation of the connection of all my different states and which God knew perfectly from all eternity.[448]

Part of what is referred to by the complete concept of a substance is the law of the series – or the 'laws included in the subject'. What is needed, in order to characterise Leibnizian identity, is an ontological correlate of the complete concept. We need to find the thing that actually links predicates in the subject. This link, Leibniz refers to as "A certain efficacy residing in things, a form or force such as we usually designate by the name of nature." [449] This nature holds the key to the identity through time of individual substance for Leibniz. It forms the grounding of the link between predicate and subject, or speaking ontologically, between perception and monad. We can call this the 'enduring active force' account of monadic persistence (EAF). The introduction of genuine force is the only way that Leibniz can provide an adequate account of monadic change. He must characterise the successive change in states of the monad in concrete, rather than conceptual terms.[450]

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[448] LA 43 in Gerhardt.

[449] G:4 507.

[450] What I mean is that; "the conceptual containment theory of truth is but an expression of the ontological doctrine that the link constitutive of a substance's *haecceitas* supports all change in its successive states. There is, thus, a sufficient reason in terms of a substance's nature by which the manifestations of all its attributes over time is determined." McGuire, 'Phenomenalism, Relations, and Monadic Representation: Leibniz on Predicate Levels', in Bogen, J. & McGuire, J. (eds), *How Things Are: Studies in Predication and the History of Philosophy and Science vol 29*, (Dordrecht: Reidel, 1985), p.220.

The fact that each substance itself is the ground of its different states occurring at different times means that Leibniz is able to account for monadic identity through time and the fact that monads continually change in terms of their perceptions. I have argued that the complete concept of the monad, whilst explaining identity, is not that in which that identity consists. Rather, I have insisted that the monadic identity is a product of some feature of the monad itself, namely its nature, or 'a certain efficacy'. Some account of this nature is owed, as is an explanation of just how nature or active force provides the key to Leibnizian endurantism.

This issue is best approached via the Leibnizian notion that true substances are, by their very nature, active. As early as 1668, Leibniz links the concept of substance with the possession of an intrinsic principle of action. These *supposita* exist in and of themselves and are entirely denominated by action. For Leibniz, whatever acts may be called a *suppositum*, or an individual substance. This doctrine, that of *actiones esse suppositorum* comes to be seen by Leibniz as the measure of true substance, and something by which those substances can be differentiated from mere phenomena.[451] The principle simply states that everything that acts is a substance and substances always act.[452] However we can, (as Leibniz does), make a distinction between the source of monadic activity and that activity itself, such that

... there can be no action without a power of acting, and conversely, a power which can never be exercised is meaningless. Yet, activity and power are different things, *the former a matter of succession and the latter permanent.*[453]

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[451] For a discussion of this point, see Leibniz's *Discourse on Metaphysics* (1686), and *On Nature Itself* (1698), both in PM.

[452] As has been noted, by the time Leibniz arrives at his mature doctrine monads become the only entities that fit this criterion. Monads are the only created entities capable of action, and thus take on the role of genuine substances.

[453] G:4 509. *On Nature Itself.* (emphasis added).

It is this power or source of monadic activity that constitutes that in which monadic identity inheres. The internal constitution of each monad contains a power that is the ground of its trans-temporal identity. Seeing monadic identity in this way has the advantage of accounting for monadic change, a task which conceptual containment fails to achieve. Ironically, it turns out that the explanation of change succeeds, only in so far as it depends upon something which is unchanging. Monadic power or primitive active force explains change, however, this force is permanent. It is something that does not change, although it may produce change itself. So:

A permanent attribute of an individual substance, then, is its power to act. As the inherent power of substances is at all times exercised, there is present a preexisting tendency to change. This tendency is continuously actualized, and every state of each substance ineluctably passes to the next state. Hence activity is a general consequence of the power of substances, and arises from the intrinsic tendency of successive states to change. Since activity results from an inherent tendency to change which always strives to actualize itself, this is tantamount to ascribing final causes to nature.[454]

The active force of the monad is always exercised whilst that monad exists. Therefore, on this account, the cause of perceptual change in monads is a unique active force, which is intrinsic and essential to each monad. This then means that change in monadic perceptions is a result of

... a nature or an internal force that can produce in it, in an orderly way ... all the appearances and expressions it will have, without the help of any created being.[455]

There is ample textural support for this interpretation of Leibnizian identity. Take for example Leibniz's frequent assertions that monadic action arises "spontaneously,

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[454] McGuire, ''Labrynthus Continui', p.301.

[455] AG 144.

arising out of its own depths"[456], or the comment that substances act "as it were by a private miracle, on the sole initiative of their own power."[457]

So, what exactly does the 'primitive active force' amount to? This property of the monad, known as 'apperception' is a dispositional property.[458] It is an internal tendency of simple substances, by which according to a certain law of their nature they pass from perception to perception.[459] This intrinsic force is a permanent attribute. It is an invariant property, which no monad can ever lack. Perceptions are the variant modes or accidents that constantly undergo change under the causal influence of this force.[460]

Leibniz frequently characterises the primitive active force of monads in terms of laws. Some have argued that Leibniz, in fact wants to *identity* substance with laws themselves.[461] There is no doubt that any attempt to characterise Leibnizian

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[456] NE 210.

[457] PM 100.

[458] For a good account of apperception and perception and a view of monadic identity not unlike the one defended here see Jan Cover and John Hawthorne's *Substance and Individuation in Leibniz* (Cambridge: Cambridge University Press, 1999), pp.214-552.

[459] G:2 275, *Letters to de Volder.* I am aware that much more could be said about powers and the relation between dispositional and categorical properties. However, space does not permit a full treatment of these issues. For the contemporary debate regarding powers and dispositions see: Armstrong's *World of States of Affairs* chapter five; and recent works by Brian Ellis, and C.B Martin.

[460] Note that the force in monads has an analogue in the force in phenomenal things, which is said to explain *their* changes in properties. However, the force in monads is metaphysically more fundamental than the force in phenomenal entities. This leads Leibniz to form a distinction between primitive force, which is active and is possessed by monads, and derivative force, which belongs to phenomena and is derived from the primitive force in monads. Motion and phenomenal change are said to supervene on the intrinsic force internal to every monad. For a discussion of this point, see AG 119.

[461] This issue is, sadly, beyond the scope of this chapter. But see especially Robert Adams, 'Predication, Truth and Trans-World Identity in Leibniz', in Bogen J. & McGuire J., (eds) *How Things Are: Studies in Predication and the History of Philosophy and Science vol 29*, (Dordrecht: Reidel, 1985), pp.235-283. Adams also tends to attribute monadic identity to the existence of these laws. For example, "Successive momentary states belong to the same individual substance, according to Leibniz, if and only if they are

identity must make reference to laws. Take for example this passage in which we find the claim that "there is a certain persisting law which involves the future state of that which we conceive as the same: that is what I say constitutes the same substance."[462] This begins to suggest that successive momentary states belong to the same individual substance only if the same persisting individual law produces them. However, I do not think that this can be the case. Like complete concepts, the laws that are embodied by monads are relevant to monadic identity. Nevertheless, they are not that in which that identity consists. Rather, it is that to which those laws apply that accounts for monadic identity. This is, as I have said, the monad's primitive active force, which gives rise to the monad's continual series of differing perceptions. We can now understand what the laws included in the complete concept refer to. They refer to the monad's primitive active force, which gives rise to the monad's continual series of differing perceptions. This, I think is a plausible way to interpret the role of laws in monadic identity. It seems that Leibniz explicitly makes this point when he says:

Perception is the operation proper to the soul, and the *nexus* of perceptions, according to which the subsequent ones are derived from the preceding ones, makes the unity of the perceiver.[463]

Therefore, it is not correct to say that this 'indwelling law', or 'law of the series' is the basis of the identity through time of substances. I would rather say, as I think Leibniz does, that it is the 'nexus' of these laws, or the active force of the monad that grounds this identity. On the enduring active force account perceptual change in monads is a result of a unique tendency toward activity. A monad derives its persistence from the

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produced by the same persisting individual law." (p. 80) See also Noel Fleming's 'On Leibniz on Subject and Substance', *Philosophical Review* XCVI (1987) pp.69-95.

[462] L 535.

[463] L 599 (emphasis added).

action of this force. That is, each non-initial, non-miraculous state in any particular

monad arises (with God's concurrence) from the agency of the monad itself. This is

reflected, I think in Leibniz's frequent insistence that:

Each substance is like a world apart, independent of all other things, except for God; thus all our

phenomena, that is, all the things that can ever happen to us, are only a consequence of our being. [464]

This account locates the nexus of monadic identity in the inherent power present in each

monad. This account fares better than the efficacious perceptions model and the

conceptual unfolding account on several scores.

Miraculous action affirmed

First, we have seen that both the conceptual and the efficacious perceptions

interpretations run into difficulty when attempting to differentiate between natural and

miraculous states of the monad. Recall, that this problem was that certain states, namely

those produced as part of God's extraordinary concourse, will disrupt the identity

through time of the monad. But will the enduring active force account also face this

problem? We can formalise the enduring active force account like so;

(EAF) Monad x at time t_1, in perceptual state p, is numerically identical with monad y at

time t_2, in perceptual state q, if and only if there exists a primitive active force P, which

is intrinsic and common to both x and y.

Note that this can account for miraculous action. True, a miraculous state

will be the product of God's action, but this will not matter a bit. Nowhere in our

formulation is the stipulation that perceptual states are caused by the same primitive

active force. The formulation merely requires that only the monad *possess* the same

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[464] AG 47/GP:iv 439.

force. However, even if primitive active forces must be real causes of perceptual states, miracles can still be accommodated on this view. Here, I borrow a strategy from Robert Adams, with whom I share a preference for the enduring active force account.[465] Adams maintains that we should see primitive active force as responsible for monadic identity through time, and should distinguish between natural and miraculous outcomes of that force. Adams makes use of a Leibnizian distinction between different types of laws. Miracles conform to the universal law of the general order.[466] This universal law has no exceptions, not even miraculous events. It governs the mutual relations of absolutely all substances and events in the universe. The universal law of the general order expresses the general order of the actual world and cannot be comprehended by any created mind. However, miracles do *not* conform to the subordinate maxims, or laws of nature.[467] These subordinate maxims range over all that is natural. These laws can be comprehended by created minds and can, in principle, be discovered by the natural sciences. These are the laws to which miracles provide exceptions. Adams argues that the both the universal law of the general order and the laws of nature are contained in the primitive active force of the monad. For this reason, miraculous action can occur to a monad, without that monad suffering a disruption in its identity. Here is Leibniz on this directly.

If we include in our nature everything that it expresses, nothing is supernatural to it, for it extends to everything, since an effect always expresses its cause and God is the true cause of substances. But as that which our nature expresses more perfectly belongs to it in a special way, since it is in that that its power consists, and since [its power] is limited, as I have just explained, there are plenty of things which surpass the forces of our nature, and even those of all limited natures. Consequently, in order to speak more clearly, I say that miracles and extraordinary cooperations of God have this peculiarity, and that they

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[465] Adams, 'Predication, Truth and Trans-World Identity in Leibniz', p.269.

[466] PM 28-9.

[467] Ibid., 29-30.

could not be foreseen by the reasoning of any created mind, however enlightened it might be, because the distinct understanding of the general order surpasses them all.[468]

Adams' resolution of the problem of miraculous action rests on matters of metaphysical rigour. The question is – can we say that in a way, miraculous action is a result of the monad's own primitive active force, and yet in another way, it can be seen as emanating from God's causal power? Adams claims that we can, as is seen in this passage.

Now if something happens in a substance miraculously, in a way that does not agree with the laws of nature that finite minds can understand, the reason for that event will presumably be vastly less distinctly "known in the substance" (that is, it can much less easily be read off the previous states of the substance) than if it were produced in accordance with those laws of nature. And this will be a reason for saying that in the miraculous event the substance is not active, nor exercising any power, and that the event exceeds anything it has the "power" to produce - even though, in metaphysical rigour, the miraculous states of the substance are produced by the substance itself in accordance with the universal law of the general order that is included in the "essence" that God has given the substance.[469]

Leibniz of course recognises the difference between loose and rigorous ways of characterising such matters. It is true that the primitive active force of a substance is the basis of that substance's identity. But of course, in rigour, it is also true that God is the basis of that primitive active force. We can ask – But which one is the real cause? I would answer, as I think Adams would – both are real causes of monadic identity. For this reason, we find Leibniz making qualifying statements, such as:

I grant *in some way* ... that God continually produces or conserves in us that energy or activity which according to me constitutes the nature of substance and the source of its modifications. But I do not grant that God alone acts in substances, or alone causes their changes.[470]

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[468] Ibid.

[469] Adams, 'Predication, Truth and Trans-World Identity in Leibniz', p.270.

[470] G:4 588f. (emphasis added).

Therefore, Adams' strategy is to claim that although a miraculous state is, in a sense, produced by God, the primitive active force of that monad, in an equally important sense, produces it. Moreover, if that state is produced by the monad's force, there is no disruption of monadic identity.[471]

The causal dilemma avoided

A second reason for preferring this account is that it does not face the causal dilemma that confronts the efficacious perceptions account. This is because the enduring active force account does not ground identity in a causal relation. Identity, it turns out, is grounded in the endurance of active force, something that is permanent, and persists strictly through time. This is not to say that there is no causation going on within the monad. On the contrary, monads remain the centre of all genuine causation. What I want to maintain is that this intra-substantial causation, between active force and perception is not the basis of Leibnizian identity. That is, Leibniz does not hold a causal account of identity. Rather, he posits the strict endurance of primitive forces. In order to explain what I mean by this, it is necessary to consider the different causal chains at work in the Leibnizian metaphysic.

There are four different causal chains at work in the Leibnizian system. First, we can say that a monad's complete concept causes a monad's states. Second, we can say that the monad's internal primitive force causes the states of the monad. Third, we can say that the preceding perceptions of that monad cause subsequent states of the monad. Or, we could say that God's plan (that is, the creation of the best of all possible

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[471] A second way we might resolve the problem of miraculous action is simply to claim that miraculous states of monads are those states that are *not* caused by their individual natures or intrinsic forces. We can

worlds) causes the states of the monad. How can the states of a monad have four different causes? This is an example of Leibniz's attempt to rescue Aristotelian causes. All of these things are causes of the states of the monad, but they are different types of causes. The scenario looks something like this. The monad's individual complete concept is a formal cause of perceptual change. The monad's own internal primitive force may be said to be an efficient cause, whilst preceding perceptions of the monad are merely a material cause. God's plan, of course, functions as the final cause of all monadic activity.[472] The question now becomes; which causal chain is responsible for monadic persistence? Complete concept has been dismissed for the reasons outlined earlier, (namely, the problem of miraculous action, and the need for non-conceptual analysis). Preceding perceptions of the monad have also been ruled out, again because of miraculous action and due to the anachronistic reading of causation it attributes to Leibniz. Similarly, God cannot be responsible for Leibnizian identity. If God is causally responsible for persistence, Leibniz will surely succumb to Spinozism and/or Occasionalism. The only way to avoid a system according to which substances are modes of God, or one in which God is required to constantly conserve and maintain substances, is to grant genuine causation for genuine substances. Therefore, the volitional power of the monad or primitive active force is the ground of Leibnizian identity. True, there is causation occurring, but this is not that in which identity consists. Identity consists in the fact that a monad, at each of several different times possesses the

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thereby deny that the monad's primitive active force causes *each* non-initial state of that monad. In this way, the identity of the monad is not be disrupted by a miracle, and room is left for miraculous action.

[472] I borrow this idea from Lois Frankel 'The Value of Harmony in Causation in Early Modern Philosophy', in Stephen Nadler (ed.), *Causation in Early Modern Philosophy: Cartesianism, Occasionalism, and Preestablished Harmony,* (Pennsylvania: Pennsylvania State University-Press, 1993), pp.197-217.

same or numerically identical enduring active force. This force endures, and as such is wholly present at each stage of the monad's history.[473]

World apart and pre-established harmony explained

Another advantage of the endurance interpretation is that it makes sense of Leibniz's views about causation and pre-established harmony. If Leibnizian identity is causal, as Sleigh would have it, some account must be given of the causal relation said to unite perceptions such that they are perceptions of one substance. Leibniz sees causation as involving four main theses. First, the doctrine of Spontaneity, according to which the phenomena of each created substance are only a consequence of its own being. This is just Leibniz's view that all genuine causation is immanent, or intra-substantial. Second, is the doctrine of World Apart, according to which each created substance is a world apart, and independent of every other substance except God. This doctrine entails the denial of transeunt or inter-substantial causation. Third, is the doctrine of Concomitance, whereby God is said to fine tune substances such that they enter into a pre-established harmony. This harmonious world is not genuinely causal, but only apparently so. Each created substance accommodates itself to every other substance, thereby generates a concomitance or harmony among substances. Fourth, is the doctrine of Covariation, whereby quasi, or non-genuine causation, is said to rely on a quasi-causal connection which depends on the inverse covariation of degrees of expression.

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[473] The fact that Leibnizian identity is endurantist rather than perdurantist means that the account avoids the threat of circularity, which we saw confront causal perdurantist accounts of persistence.

This is what Leibniz means when he claims that each created substance expresses the whole world and present, past and future.[474] Sleigh claims that

... the theory of concomitance or harmony [is] intended by Leibniz as a general account of causality, the foundations of the orderliness of the universe, and the relation of mind to body.[475]

I want to disagree with Sleigh on this point. Leibniz does not see harmony as 'a general account of causality'. Rather, concomitance or harmony is Leibniz's way of expressing the nature of non-genuine, or quasi-causation. Quasi-causation amounts to concomitance, whilst genuine causation is said to be immanent and truly efficacious.[476] In fact, Leibnizian causation can only be made sense of on an endurantist interpretation of monadic identity. We know that Leibniz holds the following in relation to causation:

(i) Transeunt or inter-substantial causation is apparent, and is only the result of pre-established harmony and the inverse covariation of substances;

(ii) Genuine causation is immanent, or intra-substantial;

(iii) This genuine causation does not consist in an influx (or transference) of being, as Suarez maintains; and

(iv) Genuine causation is not a mere occasion for God's divine action, as is maintained by Malebranche.

We might add here that Leibnizian causation is non-Humean. This seems a correct interpretation of Leibniz on causation. But despite Sleigh's analysis it is not Leibniz's

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[474] We should note here, that the orthodox interpretation of Leibnizian causation, as presented above, is not held universally. For example Phil Dowe argues that, in fact, Leibniz has no theory of causation to speak of and could have consistently adopted either influx of being, or occasional causes without contradiction. See Dowe's 'Leibniz on Causation', (paper presented at HOPOS 2000: Third International History of Philosophy of Science Conference, Vienna, July 6-9, 2000).

[475] Sleigh, *Leibniz and Arnauld*, p. 138.

view in regard to identity. The mistake comes because Sleigh thinks that individual

perceptions of substances are causally efficacious. However, the doctrine of Spontaneity

is not a statement of genuine causation between monad stages. It is a statement about

the genuine causation between enduring force and perceptions.

An endurance interpretation of monadic identity explains why Leibniz

denies transeunt causation. For Leibniz, each substance is a world apart and as such has

no causal influence on any other substance. What looks like inter-substantial causation

is in fact pre-established harmony. It is true that the perceptions or accidents of the

substance change, as their degrees of distinctness change. This is what is meant by the

claim that all created individual substances 'mirror' one another. However, there is a

real sense in which a substance's dispositional power of acting, or apperception, does

not change in relation to the apperception of other monads. This I think is the basis of

the 'world apart' doctrine. Each substance, although reflecting all others, remains a

world apart from every other substance.[477] Imagine an individual substance X that

changes such that it manifests first $state_1$ and then $state_2$. I have argued that these states

are not causally related. The states of X do not stand in a relation of genuine causation

to one another. Similarly, $state_1$ of X does not cause any $state_n$ of any distinct substance,

say Y. This is what is meant by 'World Apart'. An endurantist interpretation shows us

why this is the case. For if it were the case that $state_1$ of X could cause any $state_n$ of a

distinct substance Y, it would have to do this via some causal action of the active force

of X upon the active force of Y. However, given the doctrine of World Apart, the active

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[476] Real causal power within substances underpins Leibniz's defence of freewill, and his attack on Cartesian Occasionalism.

[477] I am not saying that I too want to deny transeunt causation as occurring between substances. What I am saying is that the interpretation of Leibniz as presented here, goes some way to understanding why Leibniz holds the world apart doctrine.

forces of X and Y do not causally influence one another. It seems then that the 'windowlessness' of active forces entails that the states of distinct substances do not cause one another.

In addition, an endurantist interpretation points towards a clearer understanding of the doctrine of pre-established harmony. The states of substance X and those of substance Y covary in accordance with a pre-established harmony. This inter-state covariation is analogous to the relation between states of one substance. Inter-substantial state covariation is reflected by intra-substantial state covariation. *State*$_1$ and *state*$_2$ of substance X covary in the same way that *state*$_1$ of substance X and *state*$_n$ of substance Y covary. Two successive states of substance X might appear to cause one another. However, this causation is not genuine, but merely apparent in the same way that the 'causation' between states of distinct substances is merely apparent. Two successive states of substance X are, in fact, joint effects of a common cause, the enduring active force of X. In the case of states of distinct substances X and Y, these states are distinct effects of distinct causes, namely the enduring active forces of X and Y respectively.

In conclusion then, an endurance interpretation puts causation where it ought to be, that is, within one substance. This interpretation also helps us understand why Leibniz denies intra-substantial causation, and posits pre-established harmony. The mistake of the causally efficacious interpretation is to think that genuine causation is to be found between perception and perception. As I have argued this is merely apparent causation for Leibniz. The genuine causation within individual substances occurs between enduring active force and perception.

6.3 Causal endurantism: a new account

I propose a new account of identity, based on Leibnizian endurantism. This account does involve causation, but not causation between the successive states of a substance. Rather, these states are joint effects of a common cause. For this reason, the new account is not perdurantist in a conventional sense. Causal endurantism places immanent causation, not between state and state, but between an enduring entity and those states. That which endures is a continually actualised disposition to change. Figure 3 represents causal endurantism.
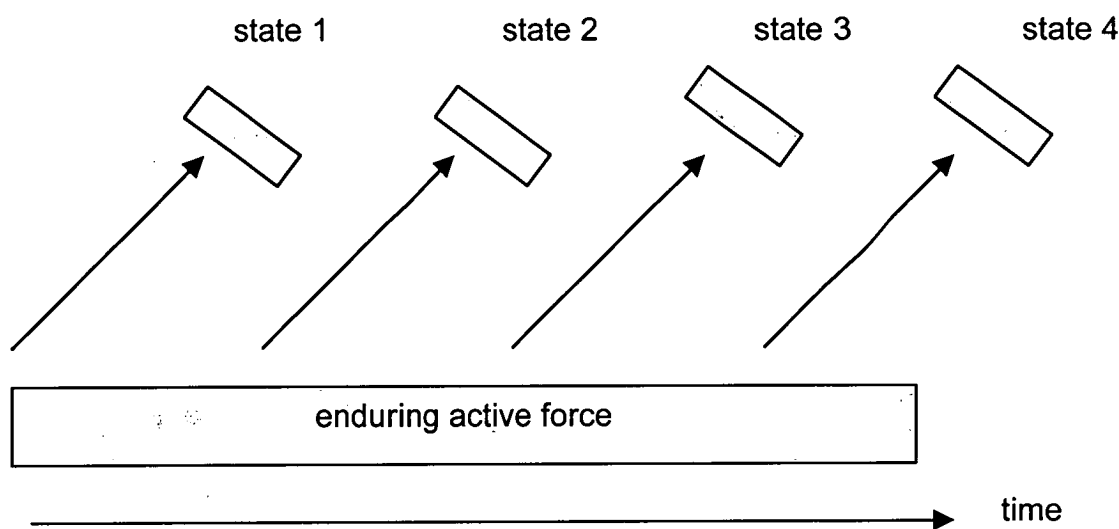
Figure (3): Causal endurantism

Figure 3 represents causal endurantism, according to which an enduring active force, or internal principle of change, causes the successive states of the persisting substance. It differs significantly from the efficacious perceptions interpretation. On that view, identity is grounded in causal relations between state and state. Here, we can see that causation is still occurring, but it is not responsible for identity. The states of the substance are fleeting, but they are the joint effects of a common, enduring cause. I have called that cause enduring active force.

Causal endurantism and the problem of temporary intrinsics

Causal endurantism is not open to the challenges that confront conventional

endurantism as characterised in chapter one. The problem of temporary intrinsics that

usually confronts such accounts will not apply. Recall this was the problem that if an

entity endures through time how is it, (given the indiscernibility of identicals), that this

entity can withstand change in its temporary intrinsic properties and yet remain the

same substance? Looking again at the problem of temporary intrinsics, it was expressed

as:

Where Lewis is a persisting entity and time t_1 is antecedent to t_2;

(1) Lewis at t_1 is identical with Lewis at t_2

(2) Lewis at t_1 is bent

(3) Lewis at t_2 is not bent

(4) If Lewis at t_1 is identical with Lewis at t_2, then Lewis at t_1 is bent if and only if

Lewis at t_2 is bent

(5) Lewis at t_1 is bent and is not bent.

We can represent the solution that causal endurantism provides to this problem in the

manner of Figure 4, which represents a scenario in which (indecisive) Lewis is standing

and then sitting and then standing and then sitting. As (indecisive) Lewis' shape

changes, we can say that one persisting object is changing over time with respect to its
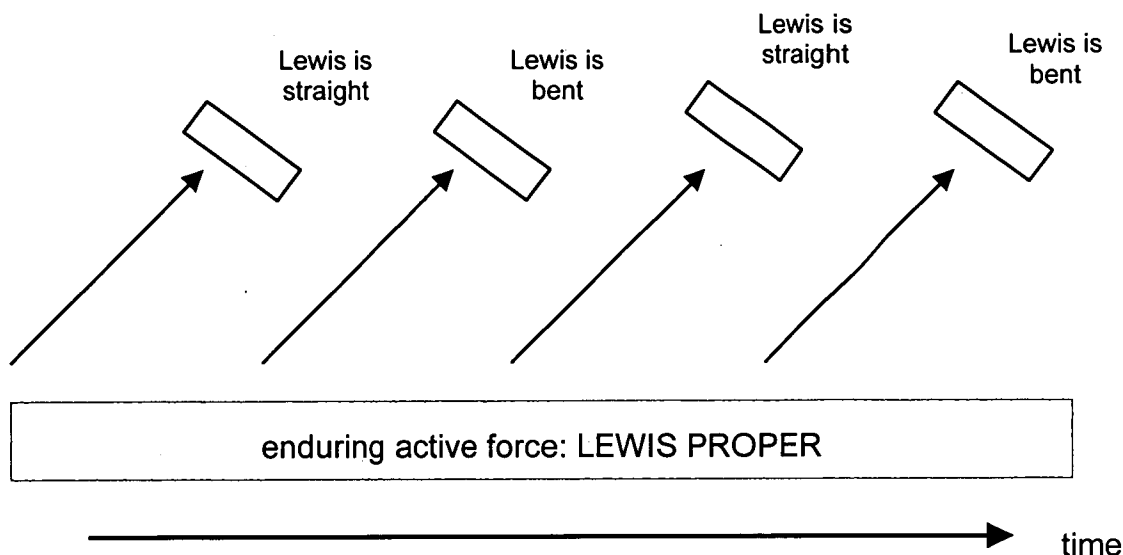
temporary intrinsic properties.

Figure (4) Temporary intrinsics (indecisive Lewis)

Causal endurantism involves drawing a distinction between Lewis-Proper and Lewis-stages. Lewis-Proper endures through time and causes each three-dimensional Lewis-stage.[478] Each Lewis-stage has certain temporary intrinsic properties, for example, shape. However, Lewis-stages do not change their temporary intrinsics. Each successive stage might exhibit a different property, but this is not the same as saying that one Lewis-stage changes in its temporary intrinsics. We might ask, in virtue of what are the successive Lewis-stages called 'Lewis'-stages? The answer is that each successive 'Lewis'-stage deserves the name in virtue of the fact that it is caused by Lewis-Proper.[479] The fact that all the stages are joint effects of a common cause means that we

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[478] Note that some Leibnizian commentators take both Lewis-Proper and Lewis-stages to be in time, and this is reflected in Figure 4. Others maintain that, for Leibniz, although the Lewis-stages are in time, Lewis-Proper is not. For a discussion of Leibniz's view about time see my 'Leibniz and the Causal Theory of Time' (unpublished manuscript), and McGuire's 'Labrynthus Continui'.

[479] What exactly is the nature of this causation for Leibniz? This question is by no means settled. If we know anything at all about Leibniz's thoughts on causation, we know that all genuine causation is immanent in the manner represented in Figure 3.

can correctly call them stages of one persisting substance. In other words the stages represented in Figure 4 as 'Lewis is straight' and 'Lewis is bent', might better be called 'Lewis-stage$_1$' is straight and 'Lewis-satge$_2$ is bent'. The Lewis-stage$_1$ that is straight and the Lewis stage$_2$ that is bent are wholly distinct Lewis-stages that have a common cause. In fact Lewis-stage$_1$ and Lewis-stage$_2$ are as distinct as Lewis-stage$_1$ and Lewis-Proper. Moreover, the fact that these two stages are distinct means that their properties are compossible. Distinctness means that the fact that Lewis-stage$_1$ is straight is in no way incompatible with Lewis-stage$_2$ being bent, simply because Lewis-stage$_1$ is not identical with Lewis-stage$_2$.[480]

This solution should sound familiar. It is in many respects like the conventional perdurantist solution to the problem of temporary intrinsics outlined in an earlier chapter (§2.3). The conventional perdurantist solution is of course that Lewis-Proper is not wholly present at both t_1 and t_2. On this solution it is not the case that one

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[480]We might think that the endurance of Lewis-Proper only provides a solution to the problem of temporary intrinsics because it represents an *unchanging* dispositional property. However, we must exercise caution at this point. The solution offered by causal endurantism does *not* arise simply in virtue of the fact that a substance's tendency towards change is invariant and essential. If it were we will have shown no more than that entities that do not change with respect to their non-relational properties might endure rather than perdure. This worry is reminiscent of a debate between E.J Lowe and David Lewis in regard to fundamental particles and the problem of temporary intrinsics. Lowe gives a response to the problem according to which an object's shape at any given time supervenes on the shapes and spatial relations of that object's constituents at that time. His worry is that he has effected an infinite regress. Lowe argues that this regress is not a vicious one because of the existence of fundamental particles. The regress is terminated at the level of fundamental particles, which have all their intrinsic properties unchangeably. Lowe concludes that "modern physics offers us a solution to the problem of change which renders superfluous Lewis's solution in terms of temporal parts." Lewis's replies that it by no means certain that fundamental particles have no temporary intrinsics. But Lowe's solution is not causal endurantism. Enduring active force does not succeed in this regard because it is permanent and essential to the substance. Rather, the solution is given by way of the nature of force, and the fact that it is the *cause* of permanent change. To put it another way, what is important in this solution is not what force

thing possesses contradictory properties, rather two temporal parts of the mereological

sum, Lewis, have different properties and this is clearly not contradictory. As Lewis

himself says, 'there is no problem at all about how different things can differ in their

intrinsic properties'.[481] Causal endurantism exploits the perdurantist solution in that it

also makes successive Lewis-states distinct and takes advantage of the fact that two

distinct stages possessing differing temporary intrinsics is not contradictory. This

solution looks like a perdurantist one, there is a real sense in which this is the case.

However, this causation is not between state and state, as the conventional perdurantist

would have it. Rather, the causation is between force and state. There is no sense in

which causal relations between states are responsible for persistence. Therefore, on

causal endurantism it is not the case that distinct stages cause one another. Rather, they

are effects of something further, namely Lewis-Proper. In addition, in contrast to

conventional perdurantism causal endurantism makes no commitment about the status

of the sum of all Lewis-stages.[482]

In fact, this solution entirely recasts the problem of temporary intrinsics.

The problem is traditionally framed in the following terms. Lewis instantiates two

contradictory temporary intrinsics, namely, being straight and being bent. Causal

endurantism reframes the problem and instead has it that two distinct stages are caused

by Lewis-Proper to have contradictory temporary intrinsic properties. Or to put the

solution another way, there is nothing contradictory in saying that Lewis-Proper causes

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does *not* do, namely never change. The fact that force is invariant is not what is doing the work. Rather, it
is what force *does* do that makes the difference, namely the fact that it is permanently exercised.

[481] Lewis, *Plurality*, p.204.

[482] And this is surely an advantage of the view. I said earlier (§2.3) that the perdurantist solution will only
succeed in as far as it provides some analysis of the sense in which an aggregate object can derivatively
exemplify an intrinsic property. Causal endurantism carries no such burden simply because it makes no
promises in regard to such aggregate objects.

two different Lewis-stages to exemplify different temporary intrinsics.[483] So, there is a real sense in which causal endurantism is a perdurantist solution. Namely, it exploits the fact that the changing states of the substance are distinct, just as perdurance view sees temporal parts as distinct individuals. However, there is an equally important sense in which causal endurantism is endurantist, for although three dimensional Lewis-stages do not persist, Lewis-Proper endures through time. Lewis-Proper is that which causes these distinct states and is that, in virtue of which, these states *are* states of one persisting substance.[484]

Recall that Lewis-Proper is equated with an active principle of change, or what Leibniz calls appetition. Or:

15. The activity or internal principle which produces change or passage from one perception to another may be called Appetition. It is true that desire [*l'apetite*] cannot always fully attain to the whole perception at which it aims, but it *always* obtains some of it and attains to new perceptions.[485]

Leibniz distinguishes between, on the one hand, the state of the substance at a particular time (monadic perceptions) and, on the other the fact that the substance possesses an attribute such that it is in that state at that time (monadic apperception). The state of the substance is a temporary property – a particular state exists at a particular time and not

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[483] If what I have said is right and causal endurance is the answer to the problem of temporary intrinsics, might there instead be a problem about change in temporary intrinsic relations? Causal endurantism offers a solution to this problem that is analogous to that given to the problem of temporary intrinsics. On this view, the only things that change in relation to one another are the successive states or stages of substance. However, that which endures does not undergo relational change. Causal endurantism is not open to the objection that that which endures might enter into contradictory temporary intrinsic relations.

[484] It might be thought that we have unacceptably moved away from a discussion of fundamental simples, to one regarding the persistence of Lewis-sized entities. Note that, by Leibniz's lights, the truthmaker for our account of indecisive Lewis just is the fact that his constituents persist in a similar way. That is, by continually changing their states in the manner represented by Figure 3.

[485] PM 27. (emphasis added).

at the next. However, these perceptions are not intrinsic to the substance. Each substance's perception of all other substances is an extrinsic property of that substance. However, the attribute of the substance that makes this true is an intrinsic attribute of that substance. Recall, this active force is a continually actualised disposition, which is played out by the substance at all times at which it exists.

Causal endurantism and the Russell-minus objection

I argued towards at the end of chapter five (§5.6) that Douglas Ehring's account of enduring tropes cannot provide a solution to the problem of changes in parts. That account fails in this regard because the enduring entity in question is seen as having spatial extent. I said then that what is needed is some enduring entity that is not spatially extended. These unextended simples are just what Leibniz comes to in his *Monadology*. So, Leibniz has a ready answer to the problem of changes in parts, namely the fact that monads have no parts that can admit of change.[486]

However, causal endurantism provides a different solution to this problem. The advantage here is that we can have an answer to the problem of changes in parts, without being committed to the existence of Leibnizian monads. I for one do *not* want to be committed to the existence of such simples. My worry is not a commitment to

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[486] Clearly, as fundamental simples, monads cannot be extended in space. I argued in a previous chapter (§5.6) that we have good reasons for thinking that those things that are extended in space have spatial parts in virtue of that extension. Leibniz's argument for the non-extension of fundamental simples is anti-Cartesian and protracted. It forms one of the bases of his claim that monads are 'windowless', and his denial of inter-substantial causation. Here we have a direct advantage of Leibnizian endurantism over Ehring's account of enduring tropes. On Leibnizian endurantism, that which endures is necessarily non-extended. In fact Leibniz argues that if the essence of substance is to extend, then these substances will not persist through time. "[The] nature of body does not consist solely in extension ... for if there were no other principle of identity in bodies ... a body would never subsist for more than a moment." For this reason the Russell-minus problem does not arise for Leibniz.

radical atomism, but rather the threat of idealism, or at least of dualism. If we want to

preserve physicalism, as I do, the conclusions of the *Monadology* must be avoided. For

Leibniz, mereological simples, or monads are 'little souls' which are essentially non-

physical. However, spiritualism can be avoided through the adoption of causal

endurantism, and a solution to the Russell-minus problem falls out of this.

Consider Russell as he was at a certain time, t. Before t Russell was fully

intact, let's say, he had ten fingers. We will call this familiar object 'Russell-10-before-

t'. If Russell existed before t, then so did something else, which we can call 'Russell-9'.

This earlier familiar object, 'Russell-9' consists of all of Russell, except his little finger.

Russell -9-before t' is the name that we give to the object which is 'Russell-9' as it

existed before t. We now assume that at t, 'Russell-10' loses his little finger. We will

call this object Russell-10-after- t. Now, we believe that a thing can survive the loss of

some of its parts. This means that the endurantist is committed to the claim that; (1)

Russell-10-before- t is numerically identical with Russell-10-after- t. But we know that

Russell-10 and Russell-9 both survive the loss of the said little finger. Furthermore, we

believe this to be the case despite the fact that Russell's little finger is not attached to

Russell-9. The endurantist will interpret the survival of Russell-9 as a case of strict

numerical identity. That is, the endurantist will maintain that Russell-9-after- t is

numerically identical with Russell-9 as it exists after the loss of the little finger. So, the

endurantist is also committed to the claim that; (2) Russell-9-after- t is numerically

identical with Russell-9-before- t. But now the endurantist is committed to the existence

of two objects, namely Russell-10-after- t and Russell-9-after- t. How is the relation

between these two objects to be characterised? To begin with, they clearly occupy the

same region of spacetime, and they are composed of exactly the same matter. So,

Russell-10-after- t and Russell-9-after- t are part for part identical. This then, commits

the endurantist to the third claim that; (3) Russell-10-after- t is numerically identical with Russell-9-after- t. Given the transitivity of numerical identity, we can say that the three statements:

(1) Russell-10-before- t is numerically identical with Russell-10-after- t,

(2) Russell-9-after- t is numerically identical with Russell-9-before- t, and

(3) Russell-10-after- t is numerically identical with Russell-9-after- t,

taken together, entail the truth of a fourth statement to the effect that;

(4) Russell-10-before- t is numerically identical with Russell-9-before- t.

However, as we have stipulated Russell-10-before- t has a little finger, but Russell-9-before- t does not. This of course entails that the two are not identical, for to be so they must be indiscernible in their properties, and it is true that the two objects here have different shapes, mass and occupy different regions of space and so on. So it seems that, after finding themselves committed to the truth of (4) the endurantist cannot deny the contradictory statement that; (5) Russell-10-before- t is not numerically identical with Russell-9-before- t.

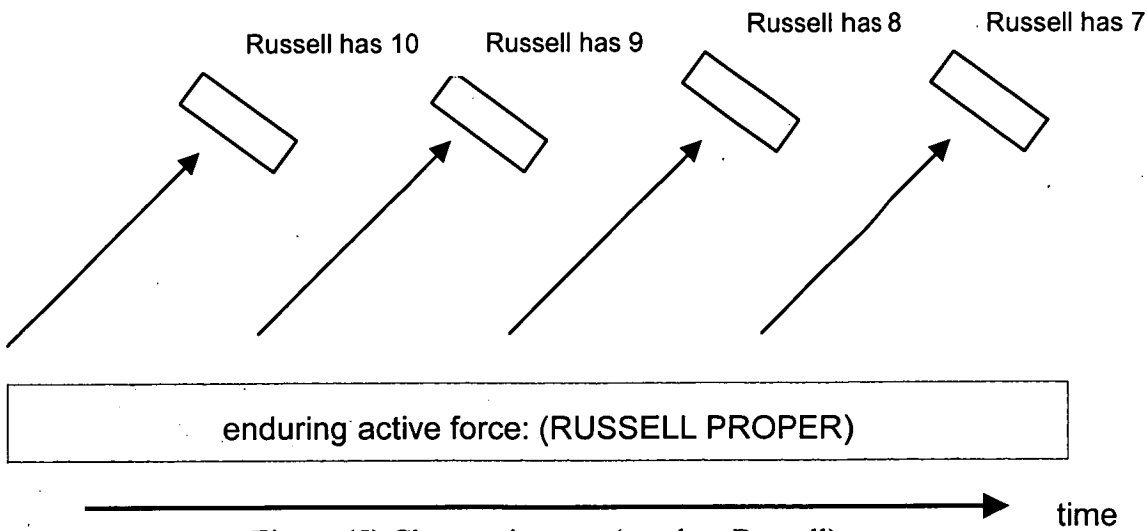The solution to this problem that is derived from causal endurantism can be represented like so.

Figure (5) Changes in parts (careless Russell)

The solution is similar to that given by the conventional perdurantist. Russell-Proper's survival through the loss of his little finger does not presuppose the truth of either (1) or (2). That is, Russell-Proper survives despite the fact that it is not the case that either; (1) Russell-10-before- t is numerically identical with Russell-10-after- t, or (2) Russell-9-after- t is numerically identical with Russell-9-before- t. The causal endurantist similarly denies that these states are numerically identical. Rather, on this view they are distinct. Herein the solution lies. However, the causal endurantist solution is not the conventional perdurantist one.[487] That solution sees Russell-10 and Russell-9 as temporal parts of the aggregate Russell-Proper. Causal endurantism makes no commitment about the sum of all Russell-stages. However, it does share a commitment to the distinctness of Russell-stages. For this reason, the causal endurantist can maintain that Russell-10 and Russell-9 are states that are caused by Russell-Proper, but are distinct. Each successive 'Russell'-stage deserves the name in virtue of the fact that it is caused by Russell-Proper. The fact that all the stages are joint effects of a common cause means that we can correctly call them stages of one persisting substance. The key

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[487] On the conventional perdurantist solution Russell-Proper is an aggregate of temporal parts, and his persistence through time is simply a matter of his having different temporal parts which exist at different times. Both Russell-10-before- t and Russell-10-after- t are to be seen as temporal parts of the aggregate Russell-Proper. For this reason there is no numerical identity between Russell-10-before- t and Russell-10-after- t. Rather, the two objects stand in the weaker relation of being parts of a single, continuous spacetime worm. In the same way, Russell-9 should be treated as an aggregate of temporal parts. So, even if it is the case that Russell-9-before- t and Russell-9-after- t do *not* differ in their parts, they remain numerically distinct temporal parts of the aggregate that is Russell-9. Russell-10 and Russell-9 are both aggregates that are related in a way that has something to do with the truth of (3) Russell-10-after- t is numerically identical with Russell-9-after- t. Russell-10 and Russell-9 are overlapping aggregates, and although they are distinct, they share a part. Their temporal parts before t are numerically distinct, however there is a single thing that is their temporal part after t. Here, we are simply referring to the thing that we first called 'Russell-after- t', and then called 'Russell-minus-after- t'. They are two separate spacetime worms, which merge after t, at which point they occupy the same region of spacetime. So, we can see that the perdurantist is able to reject both (1) and (2) in order to avoid the Russell-minus problem.

to the solution to temporary intrinsics was the fact stages are distinct from one another and the fact that enduring force is distinct from the stages that it produces. This key has also provided a solution to the problem of changes in parts. There will be no failure of transitivity because, on causal endurantism, these stages are distinct.

Note that as promised this solution preserves physicalism. The solution to the problem of changes in parts is not provided by the fact that Russell-stages are not extended in space. For Leibniz, monads lack extension and can therefore truly be said to have no parts.[488] The monad is equated with a primitive active force, or apperception. For Leibniz active force or apperception *just is* consciousness.

14. The passing condition, which involves and represents a multiplicity in the unit [*unite*] or in the simple substance, is nothing but what is called perception, which is to be distinguished from Apperception or Consciousness, as will afterwards appear.[489]

The causal endurantist is not committed to this. It might be that Russell-Proper and Russell-stages are spatially extended and physical. It is in this respect that causal endurantism differs from Leibnizian endurantism. However, the Leibnizian position has laid the groundwork for causal endurantism. The distinction between Russell-Proper and Russell-stage is the key, and the solution remains endurantist in that Russell-Proper persists through time by enduring, or being wholly present at each time at which it exists.

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[488] Some commentators point out contradiction in Leibniz's thinking here. If monads are not extended in space, what justification is for saying that they are extended in time? A simple surely must be spatially and temporally simple? Causal endurantism does not have this worry, as it is not committed to simples in the way that Leibniz is. For further discussion of this point see: McGuire's 'Labrynthus Continui'; McRae's 'Time and the monad', *Nature and System* 1 (1979) pp.103-109, and also Lois Frankel's 'Leibniz on the foundations of space and time', *Nature-and-System*. 3 (1981) pp.91-98.

Causal endurantism and rotating disc arguments

Because this new account sees persistence as a matter the endurance, it is not affected by rotating disc arguments. Those arguments, based on the states of motion of homogeneous objects were intended to point to the superiority of causal perdurantism over a perdurantism based solely on qualitative and spatiotemporal continuity (SQC). I argued in chapter four that causal perdurantism is no better placed that SQC when it comes to rotating disc arguments. I also want to point out just how RDA comes out on an assumption of causal endurantism. But first, what would Leibniz have said about rotating disc arguments?

Intuitively Leibniz's logical principles entail something about rotating homogeneous spheres. For example, an intuitive response is to say that Leibniz's metaphysics will exclude the possibility differing states for homogeneous objects. Recall my earlier discussion of RDA and the 'no difference defence' (§3.2). On this defence there simply is *no difference* between rotation and stasis in RDA contexts. We can imagine Leibniz saying something similar, for on the principle of sufficient reason there must be some reason why the disc is in a state of rotation rather than one of stasis. If there is no such sufficient reason, then there must be no difference, and presumably there is nothing that *could* serve to make this difference. A second Leibnizian response might be to say that homogeneous objects are not possible objects. Imagine that the sphere is truly homogeneous. This just means that every part of the sphere is qualitatively indistinguishable from every other. But on Leibniz's principle of the identity of indiscernibles, two things, say two sphere portions, that are indiscernible are identical. How can each portion of the sphere be identical with every another? We might plausibly claim then, that Leibniz should deny the possibility of homogeneous

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[489] PM 26.

objects on the grounds that such objects are logically impossible.[490] However, as I am

not committed to these principles it will be more relevant to give a different solution to

RDA, based on the concept of individual substance that has emerged from the above

discussion. For Leibniz, such spheres are not substances. They are aggregate complexes

of substances or *phenomena bene fundata*. As such, all of their modifications supervene

on the continually changing perceptions of the simples from which they result. The

sphere results from the continual activity of a certain aggregation of bare monads.

Similarly, a certain portion of the sphere, *P*, also results from the activity of these

monads. On this picture, rotation and stasis come out respectively as;

(R) Apperception, *A*, which characterises the northwestern portion at t_2, is numerically

identical with the apperception, *A*, which characterised the southwestern portion at t_1,

and

(S) Apperception, *A*, which characterises the northwestern portion at t_2, is numerically

identical with the Apperception, *A*, which characterised the northwestern portion at t_1.

A real difference has been made here, and significantly, it is a difference that is not spelt

out in terms of causal relations. Recall the dilemma that confronts causal perdurantism

in RDA contexts. If causation between sphere portions is conceived of in too weak a

fashion, the causal analysis will fail to differentiate genuine from pseudo identities and

will therefore fail to mark the difference between rotation and stasis. If on the other

hand, the causal analysis attempts to remedy this problem by introducing facts of

motion and/or facts of identity, the account will be rendered circular. Leibnizian

endurantism has none of these worries. On the first side of the dilemma, the requisite

distinction has come through. The possession of an enduring active force, or appetition

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[490] I argue in my 'Two Contradictory Solutions to Rotating Disc Arguments in Leibniz' (unpublished manuscript), that the conjunction of these solutions is contradictory.

means that non-genuine identities will be ruled out because perceptions that are the result of distinct dispositions will be deemed non-identical. In addition, no facts of identity are required in order to make this distinction. What this means is that Leibnizian endurantism can avoid RDA without falling into circularity.

Our new account of identity through time, causal endurantism, can exploit this solution because it too will mean that states that are caused by distinct enduring dispositions will be deemed non-identical. No circularity will ensue simply because causal endurantism is not a causal theory of identity. For this reason, debate as to the kind of causation occurring between dispositional force and successive states is irrelevant. Causal endurantism is not a causal theory of identity in the perdurantist sense. This is because, as we have seen causation does not take place between the successive states of an object, but rather between the continually actualised disposition towards change, and the result of the actualisation of that disposition, namely each state. In fact, causal endurantism has the best of both worlds. It exploits the conventional perdurantist solutions to both the problem of change in temporary intrinsic properties, and the problem of changes in parts without actually being a perdurantist account. That is, it does not see identity as a matter of causation between successive states. On the other hand, causal endurantism is well placed to avoid rotating disc arguments because it is, in a real sense, endurantist.

6.4 Conclusions

In this final chapter, I have argued that, for Leibniz, monadic persistence is grounded in the possession of a permanent and enduring primitive active force. I supported this view with the point that this interpretation is superior in the area of the problem of miraculous action. In addition, it does not resort to anachronistic treatments of Leibnizian causation.

That is, it preserves two important distinctions – between transeunt and immanent causation – and between genuine and apparent causation. Leibniz's account has inspired a new account, which I have called causal endurantism. I have argued that there is a real sense in which this new account is perdurantist. The successive states of an object are connected by patterns of causal relations. However, causal endurantism differs from conventional perdurantism in that the successive stages of an object are *not* causally connected to one another, but rather are joint effects of a common cause, namely enduring active force. There is an equally strong sense in which causal endurantism is endurantist. This is due to the fact that, on this view, identity through time is given by the strict persistence of a dispositional property, or underlying power, that is wholly present at each time the object exists. Causal endurantism is a hybrid account. Although it is perdurantist it is not in danger of becoming circular in RDA contexts. In addition, although it is endurantist, it can avoid both the problem of temporary intrinsics and the problem of changes in parts. The advantages of this new account are apparent even though it in no way commits us to the existence of extensionless fundamental simples. This is because identity through time is accounted for by the continually actualised causal action of a dispositional power towards activity that must, above all, endure.

List of Abbreviations

AG = *G.W Leibniz Philosophical Essays*, ed. and trans., Roger Ariew and Daniel

Garber (Indianapolis, IN: Hackett, 1989).

G = *Die Philosophischen Shriften von Gottfried Wilhelm Leibniz*, ed., C. I Gerhardt

(Berlin: Wedmannsche Buchhandlung, 1875-1890).

L = *Leibniz, Philosophical Papers and Letters*, ed. and trans., trans. Leroy E. Loemaker,

2nd ed. (Dordrecht and Boston: Reidel, 1969).

NE = *G.W Leibniz New Essays on Human Understanding*, ed. and trans., Peter Remnant

and Jonathan Bennett (Cambridge: Cambridge University Press,

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PM = *Philosophical Writings*, ed. and trans., Mary Morris & G. H. R Parkinson

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