

FOUR-DIMENSIONALISM AND THE PUZZLES OF COINCIDENCE

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1. Introduction

Often cited in defense of four-dimensionalism about the persistence of material objects is its treatment of the so-called *puzzles of coincidence*. These puzzles include the statue/lump, the ship of Theseus, Tibbles the cat, and the various fission and fusion puzzles in the personal identity literature. In their original versions, the puzzles involve changes which seem either to produce or terminate coincidence between material objects (the lump is flattened, the cat's tail is cut off, etc.), but each of the puzzles also has a modal variant in which the relevant change could have occurred but does not. 4Dists standardly take themselves to have an edge over 3Dists in the treatment of these puzzles. They claim that the original puzzles are answered easily and painlessly under 4Dism, and that their modal variants can be answered by something like counterpart theory. By contrast, they claim, 3Dists have no easy way with the originals, and no better way with the modal variants.¹

My aim here is to determine whether this is correct. I will argue that it is not, and in fact that the puzzles are every bit as challenging for the 4Dist as they are for the 3Dist. In a final section, I will tentatively suggest that reflecting on the puzzles may provide us with reason to reject 4Dism.

2. Some Preliminaries

¹ This view is widespread among 4Dists and 3Dists alike. See, e.g., Burke (1994), Hawley (2001), Heller (1990, 2000), Lewis (1976, 1986), Noonan (1989), Rea (1997a) (though for a more skeptical take, see Rea 1997b, section 4), and Sider (1996, 1997, 2001, forthcoming).

Before we turn to the main topic of the paper, we need to characterize 3Dism and 4Dism. This turns out to be more difficult than one would expect. The problem is that two distinct doctrines have been associated with ‘4Dism’ in the recent literature on persistence. The *temporal extent doctrine* holds that material objects² persist and that they do so by extending through space-time along its temporal dimension, or, more picturesquely, by being spatiotemporal worms.³ The *perdurant doctrine* holds that objects persist and do so by *perduring*, i.e., by having temporal parts. As Josh Parsons (2000) has noted, there is room in logical space for the possibility of an object’s having temporal extent while not perduring (even if not for the converse possibility). While the temporal extent doctrine does seem essential to any theory deserving the label ‘4Dism’, it is less clear that the same is true of the perdurant doctrine, especially given the fact that it isn’t entailed by the temporal extent doctrine.

Similarly, ‘3Dism’ is regularly associated with both the *endurance doctrine* (i.e., objects persist but do not perdure) and the “*no temporal extent*” doctrine (i.e., objects persist but are not temporally extended). If it is logically possible for an object to have temporal extent without perduring, then it is logically possible for there to be an enduring object that has temporal extent. Must the 3Dist deny temporal extent?

² Throughout this paper, we focus on the persistence of *material objects*. Excluded from the category of *object*, I assume, are at least the following: properties and relations (whether immanent or transcendent), *matter* or *stuff*, *quantities* in the sense of Cartwright (1970), points/regions of space or space-time, complexes built up non-mereologically from objects, e.g., *sets*, *events* (at least Kim-events) and *facts*, and entities dependent on objects, e.g., boundaries, tropes (on some conceptions). One would like to say that to be an object is to be a substance. A *material object*, I assume, is an object that has a sufficiently large range of material properties, where these include not only the familiar material properties of common sense (size, shape, color, texture), but those of our best science. I will use ‘object’ throughout to refer only to material objects.

³ In the context of special relativity, being a spatiotemporal worm is not equivalent to having temporal extent. The latter is frame-relative while the former is not. In fact, in that context, all statements about temporal extent and

It is worth noting here that an object's having temporal extent is equivalent to its perduring, *modulo* what we may call the *mereological account* of an object's being extended along a given dimension. According to this account, an object is extended along a given dimension iff the object is located exactly at a region that is extended along the dimension and, for each cross-sectional subregion of that region (with respect to the dimension), the object has a part that is located exactly at that subregion. Given this account, an object is *temporally* extended just in case it is located exactly at a temporally extended space-time region and it has parts located exactly at each of that region's temporal cross-sectional subregions. This is just a spruced up statement of what it is to perdure. It insures that an object has temporal parts for each time period of an object's existence.

Given the mereological account, being temporally extended is analogous to being extended along a spatial dimension at a time. I have length, breadth, and height because I occupy a spatial region with these features and have spatial parts at the appropriate cross-sectional subregions. Perdurantists often think of this analogy between temporal and spatial extent as one of the great strengths of their view.⁴

perdurance require relativization to a frame.

⁴ A little more formally:

O is extended along D iff: O is located exactly at some region R such that (i) R has proper D-cross-sectional subregions and (ii) for each D-cross-sectional subregion S of R, O has a part that is located exactly at S.

(We neglect relativity to a given space to reduce clutter.) There is a corresponding mereological account of an object's being extended in a given space.

O is extended iff: O is located exactly at a region R such that (i) R has proper subregions and (ii) for every subregion S of R, O has a part that is located exactly at S.

Parsons (2000) recommends that the 4Dist abandon the mereological account, and so face for the first time questions such as these: does having temporal extent require having at least *some* proper temporal parts? Or is being located exactly at a temporally extended region sufficient by itself? If the answer to the latter is affirmative, as Parsons argues, then there can be temporally extended simples. This would provide one way to explain what it could mean to say, as many endurantists do, that a persisting object is *wholly present* at each moment of its existence: all its parts *simpliciter* exist just when it does (because it has only one part *simpliciter*, itself!)⁵

We will not look further into these questions, except to note that perdurance is not mere ontological baggage for a 4Dist. Without perdurance, the 4Dist is deprived of the apparently easy and painless “partial overlap” treatment of the puzzles of coincidence, which is the topic of this paper. Only with perdurance is the 4Dist guaranteed that the statue and the lump have temporal parts that can be shared. Temporal extent is not sufficient. It is thus no accident that most self-described 4Dists are perdurantists (or at least *minimal-perdurantists*)⁶ and that most of

Given the latter account, extension in 3D space (at a time) is analogous to extension in 4D space: both involve having parts at each subregion of an extended region. The mereological account of spatial extension at a time has come under fire notably from van Inwagen (1981, 1987) and Markosian (1998).

⁵ On the other hand, if an endurantist accepts the mereological account of temporal extension, she might well find the “wholly present” formulation of endurantism unsatisfactory. See extended note 1 for further explanation.

⁶ One might argue that the (full) perdurance doctrine is not required for the “partial overlap” treatment of the puzzles, but only the doctrine of *minimal perdurance*: objects persist and do so in virtue of minimally perduring, that is, in virtue of having moment-sized temporal parts for each moment of their existence. The doctrine of minimal perdurance is equivalent to the doctrine of temporal extension *modulo* a weaker mereological account of temporal extension requiring only that temporally extended objects have parts located exactly at their moment-sized temporal restrictions.

Minimal perdurance without full perdurance, however, is in some ways inconvenient. Many 4Dists would like to say that the statue is a proper temporal part of the lump, e.g. But this claim will require separate argument, given

them accept the mereological account of temporal extension. In this paper, we will give perdurantists ownership of the label ‘4Dism’. A 3Dist, for us, will then be someone who not only accepts endurance, but who denies temporal extent.

Two further preliminary points. First, given what we have just said about 3Dism, the 3Dist need not deny the existence of *stages*, where a stage is an object that exists at and only at a single moment.⁷ What the 3Dist must deny, however, is the existence of a *plenum* of stages; she must deny, that is to say, that, for every persisting object and every time at which it exists, it is co-located with a stage (i.e., its spatial region at the time is the same as that of some stage). If she accepts a plenum of stages, she will be hard-pressed to deny that the persisting object at each time has all the same parts as its then-co-located stage. Such part-sharing would seem to give rise to a remarkable correlation of properties: I, a persisting person, am seated at *t*, and so is my co-located stage; I am slumped over, and so is my stage, etc. What could explain the correlation, if not mereologically-grounded property-borrowing of the distinctively 4D kind? What could explain the fact that both I and my co-located stage are seated at *t*, if not this: I am seated at *t* in virtue of the fact that I have as a part a *t*-stage that is seated *simpliciter*?⁸

only minimal perdurance. Also, many 4Dists accept the fusion axiom of absolute mereology (i.e., any set has a fusion *simpliciter*). This axiom, given minimal perdurance, will have the consequence that all temporal restrictions of an object’s region will contain temporal parts. Minimal perdurance may give way to full perdurance.

⁷ Some might find it peculiar to require that stages be objects (and so, by our usage, material objects). The essential contrast, though, is between a stage conceived of as a non-mereological (e.g., set-theoretical) complex built from a persisting object and a time, deriving its material properties (to the extent that it has them) from its components and their mode of composition, and, on the other hand, a stage conceived as something more closely resembling persisting objects as standardly conceived. The latter conception, which I rely on in text, should be amenable to 4Dists. See the postscript to “Survival and Identity” in Lewis (1983).

⁸ Those familiar with the exchange between Sider (2003) and Koslicki (2003) will notice that I am siding with Sider on the issue of whether the acceptance of universalism about diachronic composition commits one to the acceptance of 4Dism. One might reject Sider’s definition (2001, 59) of instantaneous temporal parts – “*x* is an instantaneous

Second, note that figuring in our accounts of 3- and 4Dism is the requirement that objects persist. We have not interpreted this as a claim that *all* objects persist, because we are allowing both sides to be in a position to admit the existence of at least some stages. But if the requirement is merely that *some* objects persist, then our taxonomy will count 3- and 4Dism as both consistent with the denial of the persistence of *ordinary* objects, i.e., of the objects spoken of in ordinary life and the sciences, (e.g., statues, lumps of clay, persons, cats, cells, molecules, and atoms (in the physical sense) etc.) Stage theorists such as Sider (1996, 1997, 2001) and Hawley (2001), who accept fusions of stages but deny that ordinary objects are such fusions, would count as 4Dists. Perhaps this is as it should be. We will skirt this particular taxonomic question, and say only that our interest lies with versions of 4Dism (3Dism) according to which ordinary objects persist, and the persistence of any object, ordinary or not, is a matter of perdurance (endurance).

3. The Puzzles of Coincidence

With these characterizations of 3- and 4Dism in place, we turn to the puzzles.

I begin with some terminology. Let us say that *x* and *y* coincide at *t* iff *x* and *y* are distinct but share all parts at *t*, and that *x* and *y* diverge at *t* iff they either become coincident at *t* or cease to be coincident at *t*.⁹ Past-to-future divergence is fission, future-to-past is fusion. We

temporal part of *y* iff there is a *t* such that *x* exists only at *t* and is a part of *y*, and for every object *z* existing only at *t*, *z* is a part of *y* only if *z* is a part of *x*" – on the grounds that satisfying the definiens does not, by itself, entail that the persisting object has the *t*-stage as a part *simpliciter*. But if all objects have Sider-temporal-parts at each moment of their existence, it is very difficult, for reasons we have explained in the body of the paper, to resist the 4Dist conclusion that they have the relevant stages as parts *simpliciter*.

⁹ Unfortunately, there is no settled terminology in the literature, although there is an emerging common ground that the sharing of parts at a time is a key factor in the puzzles. (See, e.g., Merricks 2001, Olson 2001, Rea 1997a). Our

may classify the original puzzles, then, as either fission or fusion puzzles, depending on whether they threaten fission or fusion. Because our concern in this paper is with the original temporal puzzles rather than their modal variants, we will mostly neglect modal matters.

It will help to have a representative pair of cases. I choose these, partly for their structural similarity:

Statue/Lump Fission Case: Before us is a statue of Goliath made of soft clay, and so a statue and a lump of clay. Next, we apply a flattening blow. It would appear that we have destroyed the statue but not the lump.

Statue/Lump Fusion Case: Before us is a shapeless lump of clay. We mould it carefully to take a certain shape, resembling Goliath. It would appear that we have created a statue but not a lump.

Reflecting on these cases, we have little trouble constructing strong arguments for the claim that they involve coincidence. But we are also puzzled by coincidence, and with some effort, we can justify our puzzlement by constructing an argument against coincidence. We will briefly discuss pro-coincidence arguments for the two cases above, and then consider at considerable length one of the best anti-coincidence arguments. Our reason for devoting significant space to the latter is that we want to know why coincidence is so problematic, and how, if at all, 4Dists can avoid the problems associated with it.

3.1 In Favor of Coincidence

Pro-coincidence arguments follow a basic pattern. First, one appeals to a difference in a property

use of ‘coincidence’ is similar to Rea’s (1997a) use of ‘constitution’, with the exception that ‘x and y coincide’, for us, implies ‘x is distinct from y’. Some philosophers (e.g., Olson 2001) use ‘material coincidence’ for coincidence

at a time during which the objects are co-located (i.e., located exactly in the same spatial region). Then, by an application of Leibniz's Law, one infers that the relevant objects are distinct. In the statue/lump fission case, one might claim that during the time of co-location the lump has the property of *being such that it will survive the flattening*, but the statue does not. In the fusion case, one might claim that during co-location the lump has the property of *having been shapeless*, but the statue does not. Finally, one argues that the objects coincide while co-located.

One can resist such arguments by denying either the case for distinctness or the case for coincidence given distinctness. We will very briefly discuss the prospects for these paths of resistance. Our goal is only to show the difficulty of blocking the case for coincidence.

Resisting the case for distinctness involves taking one of three options: denying the existence of one (or both) of the involved objects; denying that they differ in a property; or denying the application of Leibniz's Law. Each will be a hard sell. Perhaps it is not especially hard to deny the existence of statues or lumps (students have no trouble). But statue/lump puzzles are not, fundamentally, about just statues and lumps. They are about instantiations of two kind properties, one related more intimately to an object's form, the other to its matter. Thus (e.g.), there are statue/lump puzzles about persons and bodies. Here eliminativism begins to seem like overkill: "so, you're telling me that I have to believe that I don't exist or that my body doesn't exist, just to answer these silly puzzles!" Denying difference in a property will also be difficult, for it will require denying that statues and lumps have the persistence conditions associated with "statue" and "lump" (Burke 1994). How could a statue pre-date its so-called creation, or post-date its so-called destruction? Finally, denying the application of Leibniz's Law is a radical solution, even if not entirely out of the question.

in the part-sharing sense.

The other way to block pro-coincidence arguments is to deny coincidence given distinctness. One might claim that, while co-located, the statue has an *arm* (say) among its parts, while the lump does not, and so the two do not coincide. However, the statue and the lump are composed of the same atoms, and so any part of one of them will consist of atoms all of which are parts of the other. If certain atoms, which are parts of the lump, compose the statue's arm, then why isn't the arm part of the lump, too?¹⁰ Another hard sell.

3.2 Against Coincidence

On the other side, there are powerful reasons to deny coincidence in the statue/lump puzzles above, and moreover in all the puzzles, but articulating them requires some care.¹¹ Here we put aside arguments that concede distinctness of co-located objects but reject the case for coincidence. The argument that we will discuss presupposes that if distinct objects are co-

¹⁰ For further discussion of this move, see Wasserman (2002). Another argument against coincidence, granting distinctness, might be based on the mereological principle called *weak supplementation*: if x is a proper part of y , then there is some z such that z is part of y but is discrete from x (Cf. Simons 1987). It will be necessary to relativize this to times, for our purposes: if x is a proper part of y at t , then there is some z that is a part of y at t but is discrete from x at t . Suppose Statue isn't Lump, but that they have all the same parts at t . Then Statue is a part of Lump at t but is distinct from Lump, and so is a proper part of Lump at t . And yet there is no part of Lump at t that is discrete from Statue at t . However, it is unclear why the coincidence theorist should not deny the truth of *weak supplementation* for the temporal mereology of material objects. Given a suitable extensional theory of spatial regions, the following will do much of the work of *weak supplementation* in the temporal mereology of material objects: if x is a proper part of y at t , and x 's spatial region at t is a proper subregion of y 's at t , then y has at t a part z which is discrete from x at t .

¹¹ An initial thought is that there is something incoherent in idea of two things being co-located. But, as some philosophers have pointed out (e.g., Merricks 2001, Olson 2001), co-location between distinct entities of different ontological categories is not particularly objectionable: events and their subjects may be co-located, as may a surface and a shape trope. (One entity would derive its location from the other, in virtue of being dependent on it.) And perhaps even two objects could be co-located, so long as they were made up of fundamentally different but

located, then they must also coincide.

It will help to work backward. Pro-coincidence arguments depend essentially on an assertion that the objects involved differ in a property. But perhaps, although such assertions are intuitive (and follow from plausible principles), they are an opponent's best target (when compared to Leibniz's Law and eliminativism, e.g.). If an opponent could argue convincingly for supervenience principles of the form, *if x and y have the same parts at t, then x and y cannot differ in such and such respects at t*, where the relevant respects include the very respects the pro-coincidence arguments depend on, then the opponent would take the wind out of the coincidence theorist's sails. More than this, if the class of relevant respects were extensive enough, the case for identity would become irresistible.

We need to introduce some terminology for various kinds of properties.¹² Following Perry (1972, 470), let us call a property *basic* iff its possession at a moment of time t depends on events happening at t but not on any events happening before or after t. Basic properties need not be intrinsic, but they are, as Chisholm (1976) puts it, *intrinsic to a time*. Thus, being located five feet from something is a basic property, though it is extrinsic. We also want to define *futural* and *historical* properties. Here some care is needed. We want the property "will attend

"interpenetrating" atoms or bits of matter.

¹² In this paper, I reserve the word 'property' for properties that are (i) qualitative, and (ii) not built up even in part from "zero-place" properties. An atomic qualitative property, roughly, is one that does not constitutively involve a particular individual. Complex qualitative properties are those that are built up from atomic qualitative properties. (This rough characterization of qualitative properties is borrowed from Adams 1979.) A "zero-place" property is one that, intuitively, does not impose on its possessors a real condition for its possession. A mark of zero-place properties is that they are expressible (either in English or in some extension of it) by a predicate of the form 'is such that p', where 'p' is an eternal sentence (See Zalta 1983).

I limit the use of 'property' in this way in order to avoid having regularly to note irrelevant exceptions to general principles about the sharing of properties.

class next week,” for example, to count as futural. However, its possession at a time t will arguably depend on relations holding between events at t and events a week later than t (e.g., relations of spatiotemporal continuity). So, we should not define futural properties as those properties that depend only on events happening after t , but rather as those depending on events after t but not depending on events before t . We define *historical* properties, similarly, as those that depend for their possession at t on events before t but not on events after t .¹³

These categories of property are mutually exclusive but not jointly exhaustive (consider the property *being the first-born son of a woman who will climb Everest*). However, an object’s basic, futural, and historical properties jointly fix all of its properties (recall that we are ignoring modal properties).

Return to the two statue/lump cases. One sort of argument for distinctness, applicable to both cases, appeals to basic differences at the time of co-location (e.g., the statue is beautiful; the lump isn’t). Another sort of argument appeals to futural differences in the fission case and historical differences in the fusion case. The anti-coincidence argument below thus has three steps. *Step One* rules out basic differences among coincidents; *Step Two* rules out futural differences; and *Step Three* historical differences.¹⁴

Step One. The first step appeals to the principle that in all (nomologically) possible worlds, if objects x and y have all the same parts at a time, then x and y have all the same basic properties at that time. We abbreviate this as *Same Parts* \Rightarrow *Same Basics*. This principle may be defended as follows. Perhaps objects could and even do coincide. But there are certain

¹³ A similar classification is available for relations. We will speak of basic relations below.

¹⁴ I do not claim originality for all three steps of the argument to follow, particularly not the first. Arguments similar to it in certain ways have been put forward by Burke (1992), Heller (1990), Olson (2001), van Inwagen (1990b), and Zimmerman (1995), among others.

properties that coinciding objects must share while coincident. Sphericity, for example, is fixed by having parts interrelated in certain ways, and so coincidents must be alike in this property. And the same goes for all *material* intrinsic basic properties. But it's also impossible for there to be coincident objects that differ in material *extrinsic* basic properties, such as being five feet away from a third object. And yet won't an object's having the property of beauty, a putatively non-material basic property, be fixed by the totality of its basic material properties? In fact, won't all an object's basic properties be so fixed?¹⁵

However, *Step One* is not enough. The coincidence theorist might concede that the statue and the lump, while co-located, are basic duplicates, but insist that they are not duplicates with

¹⁵ *Same Parts* \Rightarrow *Same Basics* will be resisted by some coincidence theorists, including Baker (2000), Johnston (1992), and Wiggins (1980). Rea (1997b) suggests how a coincidence theorist might reply to objections based on this principle. Coinciding objects share all parts at a time, but they supervene on different facts about how those parts (or some subclass of them) are arranged at that time. The statue supervenes on certain things being arranged *statuewise*, and the lump supervenes on certain things being arranged *lumpwise*. This is just what it is to be a statue or a lump. An object will be a candidate for those properties that are appropriate to its supervenience base and not a candidate for those inappropriate to that base. The statue will therefore count as beautiful, but the lump will not; the person will count as thinking, but the body will not. The principle *Same Parts* \Rightarrow *Same Basics* will then have to be denied. Beauty is a basic property (let's assume), and so despite having all the same parts, the statue and the lump are not basic duplicates. (Side point: Rea's strategy might be used to argue that the statue and the lump in fact do *not* have all the same parts, despite having all the same atomic parts. Perhaps the statue, in virtue of its supervenience base, is eligible to have an arm as a part, while the lump, in virtue of its base, is not.)

Olson (2001) rightly notes that Rea's proposal leaves unexplained, concerning the object which is in fact beautiful, why *it* is beautiful but the object it coincides with isn't. Both are composed of the same things, and so the same things arranged in exactly the same ways. Why does beauty apply to one but not the other? Why indeed does *being a statue* apply to one rather than the other? Doubts about the answerability of questions are exactly what motivate *Same Parts* \Rightarrow *Same Basics*.

I devote so little space to discussion of *Step One* in the body of the paper because the standard 4Dist treatment of the puzzles concedes this step, as we shall see. I touch on Rea's proposal again in my extended note 2.

respect to their non-basic properties, and therefore must be distinct.¹⁶

Step Two. This step, and the next, both depend on the crucial idea of a kind of *de re* lawful determination of an object's properties, an idea which will be central to this paper. We will assume that laws – at least laws in the actual world – subsume objects at a time by virtue of their properties. Rather than determination *simpliciter*, then, we will speak of objects as being determined to be F at a time *given* that it is G at that time. Here, then, is the general scheme for lawful determination:

Lawful Determination:

O is lawfully determined to be F at t given that it is G at t iff: O is G at t and the generalization *All Gs at a time are Fs at that time* is nomologically necessary.

Hopefully, the core idea is clear enough for now. It will become clearer as we proceed.

Now for *Step Two*. Intrinsic duplicates at a time need not have all the same futural properties. *Basic* duplicates, however, are not only intrinsic duplicates; they are also duplicates with respect to all environment-relating properties. To the extent that an object's futural properties at a time are lawfully determined given its basic *and* historical properties, it seems that its futural properties should be lawfully determined given its basic properties alone. That is, the relevant law-grounded generalization should be of the form *All Bs at a time are Fs at a time*, where 'B' picks out a possibly complex basic property. But at every moment of its existence, an

¹⁶ An aside: if the coincidence theorist accepts *Same Parts* \Rightarrow *Same Basics*, then she will be hard-pressed to allow for permanent coincidence. Permanently coinciding objects would share all their basic properties at every moment of their existence. In addition, because they have the same parts at all times, those parts at those times would stand in all the same "unity" relations (spatiotemporal continuity, etc.). It would apparently follow that they share all the same futural and historical properties. What would make the two objects distinct, then? Not qualitative difference (they are never qualitatively different). Not spatial separation (they are never spatially separated). Their distinctness would have to be grounded in modal differences which themselves would have to float free of the non-modal properties and compositional histories of the objects.

object's futural properties are determined given its basic and historical properties. It follows that (in nomologically possible worlds) basic duplicates at a time are futural duplicates at that time, or in other words: *Same Basics* \Rightarrow *Same Futurals*. This is the distinctive principle of *Step Two*. Putting it together with *Same Parts* \Rightarrow *Same Basics* from *Step One*, we arrive at *Same Parts* \Rightarrow *Same Futurals*.

Before looking further into this argument, note that *Same Parts* \Rightarrow *Same Futurals* clearly rules out futural differences in the statue/lump puzzle: given that the statue and lump share all parts at t , and so are basic duplicates at t , they must also be futural duplicates at t , *contra* the standard pro-coincidence argument. In fact, the principle rules out fission generally, at least in nonsymmetrical nomologically possible worlds.¹⁷

What about that key move of *Step Two*, that is, the claim that objects' futural properties are lawfully determined at every moment of their existence given their basic properties? This claim is not empirically unrevisable, nor is it intended to be. Properly interpreted, our best scientific theories may turn out to undermine the claim that an object's futural properties are deterministically fixed by the laws, given their basic properties. Perhaps only *probabilities* for having various futural properties are so determined. This would not be too much of a blow to the

¹⁷ The qualification about nonsymmetrical worlds needs explanation. A symmetrical world, let us stipulate, is one in which objects that are non-coincident at a time basically differ at that time. Now even in symmetrical worlds, if objects that coincide at t differ in how long they will survive after a time t , then they will differ in a futural property at t : *being an object that will exist for such and such length of time*. This is why all statue/lump cases are ruled out by *Same Parts* \Rightarrow *Same Futurals*. However, suppose x and y are coincident at t but also survive for exactly the same length of time after t . Then if they inhabit a symmetrical world, they could be futural duplicates at t . However, if we limit our consideration to nonsymmetrical nomologically possible worlds, then *Same Parts* \Rightarrow *Same Futurals* is sufficient to rule out fission. This is because, assuming x and y coincide at t_1 , and that they exist but do not coincide at $t_2 (> t_1)$, then they will differ in some basic property B at t_2 , and so will differ in a futural property at t_1 : *being an object that will be B at the time that is such and such distance in the future*.

defender of *Step Two*. She could appeal, instead, to the principle *Same Basics* \Rightarrow *Same Probabilities for Futurals*, noting that in the standard statue/lump fission case, the statue has a low and the lump a high probability of surviving the flattening blow, even though they are basic duplicates at the time. However, perhaps historical properties in some cases matter even to the determination of probabilities for futural properties. *Step Two* might then be revised appropriately, by appealing, say, to *(Same Historicals & Same Basics) \Rightarrow Same Probabilities of Futurals*. This principle will undermine futural differences in at least those statue/lump cases in which the statue and the lump have been coincident throughout their history. And so the cycle of possible refutations and possible revisions continues.¹⁸

But what if our best theories show decisively that there is simply no *de re* lawful determination of any kind remotely relevant to the puzzles of coincidence? This cannot be ruled out *a priori*. Still, for most of us, it would take the earnest testimony of the scientific community for us to give up beliefs like *this* one: the last time you released the apple from midair, it didn't just happen to fall, it *had* to fall given its situation at the time of release. Certainly, most of us are not prepared to give up such beliefs simply because holding onto them makes it hard to solve the puzzles of coincidence. And obviously the releasing of an apple is not a special case. We therefore seem to have good defeasible reason to accept *Same Basics \Rightarrow Same Futurals*.

Step Three. Finally, we need a third step to rule out historical differences between coincidents. One might hope to argue that the laws determine an object's historical properties at

¹⁸ Recall that we are using 'property' in such a way as to exclude zero-place properties. This exclusion is relevant here. If our best science allows for the possibility of certain sorts of objects into or going out of existence *ex nihilo*, under special conditions (e.g., white holes), then if there is such an event in the future, all of us right now have a zero-place future-oriented "property" that isn't lawfully determined given our current basic properties (nor perhaps is its probability for us lawfully determined either.) Because we are putting aside zero-place properties and ones

a time given its basic properties at that time, and then give an argument exactly analogous to *Step Two* for *Same Basics* \Rightarrow *Same Historicals*. I will not explore this possibility this argument, except to remark that there is some reason to think that, despite that principle's lack of intuitive appeal, an examination of the proposed laws in our best scientific theories may provide just as much support for *Same Basics* \Rightarrow *Same Historicals* as for *Same Basics* \Rightarrow *Same Futurals* (Hofer 2004).

However, our *Step Three* proceeds differently. It relies on *Step Two* to rule out fusion, and then having ruled out fusion, rules out historical differences. Fusion is ruled out by appealing to two premises: (1) objects that have undergone fusion either do or at least *could* undergo fission at some later time, but (2) fission is impossible by *Step Two*. If fission is impossible, then co-located objects cannot differ in their historical properties. Thus, *Step Three* gives us *Same Parts* \Rightarrow *Same Historicals*.¹⁹

Assuming *Step Two* is sound, (2) is true. (1) can be defended by appeal to combinatorial ideas. If a process produces fusion, it should be possible for it (or a process of its type) to occur later in reverse, producing fission. If the artist's shaping of the lump (plus a suitable creative intention) brings a statue into existence, then the artist's unshaping of the lump (perhaps plus a suitable destructive intention) should destroy it. If cutting off the cat Tibbles' tail produces fusion between Tibbles and Tib (one of Tibbles' previously proper parts), then reconnecting it should produce fission between the two. And so on.²⁰

built up from them, the anti-coincidence theorist needn't worry about *that* kind of empirical refutation.

¹⁹ Strictly speaking, we need to add a qualification about symmetrical worlds like the one discussed in note 17. I let this pass, to keep things simple.

²⁰ Note that (1) is based on combinatorial ideas that are neutral between counterpart theory and its principal competitors. The counterpart theorist will merely say that in the possible world in which the fission occurs, it occurs not between the actually fused objects but between their counterparts in that world.

One might wonder why, in place of my *Step Three*, I did not simply invoke the intuitive mysteriousness of how

All three steps of the anti-coincidence argument are now in place. Together they rule out both fission and fusion in all the puzzles.

In this section, I have taken pains to make it clear, not only why coincidence is hard to deny, but also and especially why coincidence is so problematic. In the next section, as we examine the standard 4Dist treatment of the puzzles, the question of overriding importance to us will be whether the 4Dist, like the 3Dist, must wrestle with the anti-coincidence argument we have given or whether she can somehow sidestep it.

4. Can 4Dism Help?

4.1 An Easy and Painless Answer?

We have seen that, putting aside the question of 4Dism, there is no easy and painless answer to the fission or fusion puzzles. Now see things in 4D. Many 4Dists will predict that the problem will look *much* less worrisome. In fact, 4Dists commonly talk as if the puzzles simply disappear once we adopt 4Dism. The idea, touched on earlier, is based on the familiar mantra “partial overlap is not coincidence.” What is commonly called temporary coincidence, given 4Dism, turns out to be just a kind of partial overlap, in particular partial *temporal* overlap, that is, the sharing of some but not all temporal parts. Only total overlap deserves to be called coincidence, for only with total overlap do things share all parts. Partial overlap is metaphysically unproblematic on its face (obviously, roads can partially overlap and be distinct, and similarly for temporally extended objects). Under 4Dism, there is not even a *prima facie* threat of genuine

coincidents at a time could differ historically? (Olson 2001). However, as Perry (1972) pointed out, objects sharing all parts at a region of space can differ in their spatially non-basic properties. He gives the example of Siamese twins sharing a hand. Not that the analogy *proves* anything, but it bolsters the anti-coincidence theorist’s case if she can give a reason for thinking that there is an obstacle to recognizing historical differences among coincidents which

coincidence, but only partial overlap, and so the problem is avoided.

The standard 3Dist response is to turn to the modal variants. For example, the 3Dist will refer to Gibbard's (1975) modal variant of the statue/lump puzzle. Suppose a lump (Lumpl) and a statue (Goliath) have the same spatiotemporal career, and so, under 4Dism, have the same 4D extent. Still, they have different modal properties, because one *could* have survived flattening while the other *couldn't* and so are distinct. Even the 4Dist must admit that this is coincidence.²¹

To avoid recognizing coincidence, 4Dists standardly appeal to what Harold Noonan (1991, 1992) calls "the Abelardian view of modal predicates." An Abelardian predicate is one "whose reference can be affected by the subject term to which it is attached" (1992, 134).²² A good example comes from Quine: 'Giorgione is so-called because of size'. The predicate refers to or expresses different properties depending on which name it is attached to. Abelardianism makes it possible for the 4Dist to affirm the truth of two seemingly incompatible statements:

- (A) Lumpl could have survived flattening but Goliath couldn't have.
- (B) Lumpl is Goliath.

For, (A) is true iff, relative to the sortal "lump of clay" Lumpl could have survived flattening, and relative to the sortal "statue" Goliath couldn't have survived flattening. (A) is therefore compatible with (B).

The Abelardian move is available to the 3Dist, too. But if, as it is supposed, the 3D coincidence theorist is already burdened with genuine coincidence in the original puzzles, there

lacks a parallel in the spatial case. *Step Three* provides such a reason. We will return to these issues in Section 4.

²¹ See van Inwagen (1990a) for a modal version of the Tibbles or Body-Minus puzzle.

²² There are different sorts of Abelardian views about modal predicates: one might take it as an irreducible fact that modal predication is relative to a sortal that is contextually supplied by the subject term, or one might try to understand such predication in terms of inconstant counterpart theory (Cf. Lewis 1986). See Fine (2003) for a

is little to be gained from Abelardianism in the modal variants. Not so, for the 4Dist. She does fine by the originals and only encounters problems in their modal variants, because, given 4Dism, only in the latter is there genuine coincidence. 4Dism therefore seems to have a considerable edge over 3Dism on the original puzzles.²³

4.2 Problem Sets and 4D Translation

Before we try to determine whether the 4Dist does have such an easy way with the original puzzles of coincidence, we need to say more about how exactly the 4Dist is bringing 4Dism to bear on these puzzles. This is the goal of the present section.

Let us introduce the idea of a problem set. A problem set is a set of apparently inconsistent statements, each of which appears true. Puzzling cases generate problem sets. For fission puzzles, the most troubling problem set consists of three statements: one asserting sameness of parts at a time t , one asserting a futural difference at t , and one asserting a supervenience principle ruling the possibility of that very sort of difference – in particular, the principle *Same Parts* \Rightarrow *Same Futurals*. For fusion puzzles, the most troubling problem set takes an exactly analogous shape, with ‘historical’ substituted for ‘futural’. (I am assuming that problem sets concerning basic differences at t are less troubling.)

A problem set (or the *problem* represented by the problem set) may be successfully *answered* in one of three ways: one can *dissolve* it, by showing how the problem set is consistent after all; one can *solve* it straightforwardly, by showing that one or more members of

discussion and evaluation of both kinds of proposal.

²³ The edge would not be considerable if Abelardianism about temporal predication had exactly the same advantages and disadvantages as Abelardianism about modal predication, as is claimed by Fine (1980). But for argument’s sake, let us assume otherwise.

the problem set are false; or one can give it a sophisticated *solution*, by showing that one or more members of the problem set is indeterminate in truth-value. (Only the first two sorts of answers will concern us here.) Talk of *avoiding* problems is a bit vague, but we can think of avoiding a problem as having a simple and painless answer to its corresponding problem set. Finally, to the extent that a problem set captures what is puzzling about a case, we can say that answering it suffices for answering the puzzle.

What the 4Dist must do, if she is to answer puzzles like the puzzles of coincidence, is to connect her special 4D talk of temporal parts with the talk of ordinary objects that figures in the statements making up the puzzle's problem set. And she has a natural way of doing this. If ordinary objects are 4D, then, as we briefly noted in Section 2, to avoid unexplained property correlations between ordinary objects and their temporal parts, the 4Dist will want to understand the possession of properties at times by ordinary objects as deriving from facts about those objects' temporal parts. She will want to analyze, or as we will say, to *translate*, statements about ordinary objects having properties at times into statements about those objects having temporal parts with those properties, or suitably related ones.

The 4Dist needs a scheme of translation. For *basic* properties, the scheme is straightforward:

4D Translation Scheme for Basic Properties/Relations

$\text{Tr}(\text{'x is F at t'}) = \text{'the t-temporal part of x is F'}$ (or, for short, $\text{'x}_t \text{ is F'}$)

$\text{Tr}(\text{'R}x_1, \dots, x_n \text{ at t'}) = \text{'the t-temporal part of } x_1 \text{ is R-related to the t-temporal part of } x_2, \dots \text{ the t-temporal part of } x_n \text{'}$. (or, for short, $\text{'R}x_{1t}, \dots, x_{nt}'$)

For non-basic properties, no such simple scheme is available. A non-basic property is a property that applies to an object at a time at least partly in virtue of events happening at other times. The

best the 4Dist can say in general is that a 4D object has a non-basic property at a time t in virtue of its having (or lacking) temporal parts with certain basic properties at certain times before, at, and after t . This is hardly worthy of enshrining as a translation scheme for non-basic properties. For particular properties, the 4Dist can be more informative: a person has the property of *awaking* at a time t , for example, in virtue of the fact that her t -temporal part is awake and she has sleeping temporal parts for a suitably long period of time previous to t . So 4D translation of ascriptions of non-basic properties will proceed case by case. However, and this will be relevant to our concerns, when translating open sentences of the form ‘ x has P at t ’, where ‘ P ’ ranges over non-basic properties, these sentences may be replaced by ‘ $\text{Tr}(P, t)$ holds of x ’. So, for example, the translation of ‘for all futural properties F , x has F at t iff y has F at t ’, will be: ‘for all futural properties P , $\text{Tr}(P, t)$ holds of x if and only if $\text{Tr}(P, t)$ holds of y ’.

With these rudimentary elements of the 4D translation scheme in place, we can see that the 4Dist will not be able to *dissolve* the puzzles of coincidence. Consider the statue/lump fission case again. Here is the original problem set:

(Same Parts)

Statue and Lump share all their parts at t .

(Same Parts \Rightarrow Same Futurals)

For all x, y , if x and y share all their parts at a time, then for all futural properties F , x has F at t iff y has F at t .

(Futural-Difference)

Statue and Lump differ in a futural property at t .

And here are the translations:

(Tr(Same Parts))

Statue_t and Lump_t have all the same parts.

(Tr(*Same Parts* \Rightarrow *Same Futurals*))

For all x and y, if x_t and y_t have all the same parts, then for any futural property F, Tr(F, t) holds of x iff Tr(F, t) holds of y.

(Tr(*Futural-Difference*))

There is a futural property F such that Tr(F, t) holds of one but not both of Statue and Lump.

The 4D translations are inconsistent, and so cannot, via the 4D translation scheme, reveal the originals to be consistent. The same goes for all of the puzzles of coincidence.

Nor, I submit, should the 4Dist *want* a scheme of translation that yields a consistent translation set, when applied to problem sets that are inconsistent when interpreted according to their surface logical forms. The 4Dist is not aiming to provide us with a revisionary account of logical form, or the features of ordinary statements that determine which arguments involving them are valid and which are not. 4D translation is not meant to reveal the true logical form of ordinary statements, but rather *what it is* for the translated statements to be true. By her own lights, then, she should never seek to use 4D translation to dissolve any puzzles whose problem sets are inconsistent when interpreted in accordance with surface logical form. (An Abelardian about temporal predicates, by contrast, is revisionary about logical form.)

The 4Dist, reading along, might protest: “the puzzles don’t threaten coincidence for me, and so can’t pose for me the problems uniquely associated with coincidence.” My response – and this may be all-too-obvious by now – is that the problem posed by the statue/lump case doesn’t concern coincidence *simpliciter*, i.e., 4D coincidence, but coincidence at a time. The 4Dist *does* accept the notion of coincidence at a time, because she accepts the notion of parthood at a time. (She translates ‘x is part of y at t’ as “x_t is part of y_t”.) Furthermore, at least if she

appeals to the “partial overlap” account, the 4Dist is committed to thinking that the notion of coincidence at a time applies to the relevant objects in the puzzle cases; she will agree that the statement *Same Parts* is true. Consequently, if there are problems inherent in objects coinciding at a time, then the 4Dist inherits those problems.

4.3 A 4D Solution?

So, the 4Dist cannot *dissolve* the puzzles of coincidence. Can she *solve* them? Can she help us see which members of the relevant problem sets are false, and why? We are not interested in solutions that are available with equal plausibility to both 3Dists and 4Dists. We are interested in *distinctively* 4D solutions. Such solutions may be available to 3Dists, but they must be considerably less plausible under 3Dism than under 4Dism. Moreover, we are not interested in distinctively 4D solutions that are easily bested by certain other solutions available to 3Dists. To have an edge over the 3Dist in answering a puzzle, the 4Dist needs a distinctively 4D solution that is more plausible under 4Dism than any of the solutions available to 3Dists are under 3Dism.

A distinctively 4D solution will rely on what distinguishes 4Dism from 3Dism, and therefore on the distinctive 4D ontology and ideology. In *ontology*, the 4Dist accepts a plenum of stages, as well as persisting objects having them as parts, and having fusions of them as parts. The 3Dist doesn't. In *ideology*, as we have seen, the 4Dist accepts the absolute predication of basic properties and relations and analyzes temporally relative predication of such properties/relations in terms of their absolute predication. The 3Dist, at least if she is not a presentist,²⁴ will deny the truth of all absolute predications of such properties/relations, taking

²⁴ The presentist claims that absolute predications of basic properties/relations can be true, but only for present entities presently instantiating those properties/relations. So, the statement “I am seated” can be true, without

the relativized predications as irreducible. Even the presentist 3Dist must deny the truth of absolute predications of basic properties to non-present entities, and so will deny that the truth of a statement predicating roundness to an object at a non-present time t depends in part on anything's being round *simpliciter*.

Our question, then, is whether, and if so how, the 4Dist can make these differences in ontology and ideology work to her advantage in solving the puzzles of coincidence.

To take an example in which these differences do help, at least arguably, consider the puzzle of change, or of “temporary intrinsics” (Lewis 1986). Shapes, we would like to say, are intrinsic properties. But then how can an object change its shape? A change in shape would seem to require it to have two incompatible shape properties. Standard 3Dist solutions appeal to some sort of relationality: perhaps shapes are relation to times, or if not, then at least they are instantiable only relative to a time. The 4Dist agrees that the shapes of persisting objects are had only relative to a time, and in this respect the 4Dist is on all fours with the 3Dist. But she has the resources to accommodate shapes that are not only intrinsic properties but are had *simpliciter*. For, given the 4D translation scheme, the having of shapes by persisting objects at times derives from the having of shapes *simpliciter* by their temporal parts. The 3Dist cannot duplicate this answer, not even the presentist 3Dist. The 4Dist, therefore, has a distinctive solution. Whether it is superior to all 3D solutions is a more difficult question, but perhaps the 4Dist has reason for hope.²⁵

temporal qualification, only if I am presently seated. As mentioned earlier, the presentist will analyze temporally relative predication in terms of absolute predication, as follows: x is F at t iff were t present, x would be F .

²⁵ Similarly, the 4Dist has a distinctive treatment of the following time-travel puzzle. I travel back to 1975 and take a look at “my past self.” Am I, in 1975, three feet or six feet tall? I cannot be both. The distinctive 4D treatment is this: I cannot be said to have a height in 1975, because my scattered 1975-temporal part has no height, but there is

There are, of course, many puzzles for which the 4D ontology and ideology plainly give the 4Dist no edge whatever. No one would think of invoking 4Dism to answer philosophical puzzles, say, about the nature of color. This is no surprise: the question of whether 4Dism is true has a bearing on some philosophical puzzles, but obviously not on all. Our interest is in whether it has a bearing on the puzzles of coincidence, and if so, whether this bearing gives the 4Dist an edge or not.

Return, then, to the puzzles of coincidence. Nothing in 4Dism gives the 4Dist any special reason to deny the relevant claims of futural or historical difference. 4Dism provides no grounds for thinking statues can survive flattenings, that statues but not lumps come into existence with appropriate shaping by an artist, nor that Tib goes out of existence with the cutting of Tibbles' tail, that gradual plank-replacement isn't sufficient for a ship's survival, etc.²⁶ Nor does 4Dism give us a special reason to give up the claim that the relevant objects in the puzzles share all parts while co-located. A distinctively 4Dist solution to these puzzles, then, must set its sights on the relevant supervenience principles: *Same Parts* \Rightarrow *Same Futurals* for fission puzzles, and *Same Parts* \Rightarrow *Same Historicals* for fusion puzzles. Here, presumably, is where the mantra "partial overlap is not coincidence" helps, if it helps at all.

The first thing we need to discuss is how overlap enters the picture at all. The 4D translation of *Same Parts* takes us most of the distance to overlap, but not quite. To plug the

some truth in claiming that I, in 1975, am three feet tall and in claiming that I, in 1975, am six feet tall: my temporal part consists of two person-like stages, one of which is six feet tall and the other three feet tall. The 3Dist cannot duplicate this treatment, because she lacks the ontology.

²⁶ Any reason that the 4Dist provides to reject one or another of them will be available with equal plausibility to the 3Dist. For example, if the 4Dist wants to utilize Burke's (1994) "dominant kinds" approach, according to which possession of a kind property does not assure possession of persistence conditions associated with that kind, the 3Dist may follow suit.

hole, the 4Dist needs the assumption that there is no such thing as 4D coincidence, i.e., that there is no coincidence *simpliciter*. This will license the inference that, when x and y share all their parts at a time, not only will x_t and y_t share all their parts, but $x_t=y_t$, so that x and y share a t-temporal part. I know of no 4Dists who admit 4D coincidence, and do not expect to learn of any, because 4Dists could hardly gain an edge on 3Dists if they conceded the existence of coincidence *simpliciter* of temporal parts in the original temporal versions of the puzzles.²⁷

Suppose, then, that the 4Dist embraces “No 4D coincidence” and so is positioned to see the puzzle cases as involving temporal overlap. Overlap in a t-temporal part immediately entails, given the 4D translation scheme for basic properties, that the overlapping objects share all the same basic properties at the times of overlap. (And so the 4Dist need not reject *Same Parts* \Rightarrow *Same Basics*). The challenge is to find something in the 4D ontology and ideology that enables us to see how basic duplicates at a time could have different futural or historical properties.

We will discuss three 4D proposals.

4.4 Three 4D Proposals

Proposal #1: appeal to the mantra “partial overlap is not coincidence.” To repeat, the story is this: temporary coincidence is partial temporal overlap; and partial overlap is metaphysically innocent (who would raise questions about roads partially overlapping?). This is put forward as

²⁷ The 4Dist may be allowed to rely on 4D coincidence in giving new and improved 4D translations. Thus, the new translation for *Same Parts* \Rightarrow *Same Futurals*, for example, will be this: “For all x and y, if $x_t=y_t$, then, for all futural properties F, $\text{Tr}(F, t)$ holds of x iff $\text{Tr}(F, t)$ holds of y.”

In absolute mereology, parthood is standardly taken to be a partial ordering, and so a reflexive, antisymmetric, and transitive relation. The first two conditions jointly require that things sharing all their parts are identical. (When we turn to temporal mereology, antisymmetry becomes more controversial. The 4Dist herself will of course deny that if x is a part of y at t and y is a part of x at t, then x must be y, as a check of the 4D translation of this principle

a simple and painless solution to the puzzles, and so a way of *avoiding* them. If the appeal to partial overlap succeeds, then *something* must be wrong with the principles *Same Parts* \Rightarrow *Same Futurals* and *Same Parts* \Rightarrow *Same Historicals* because they rule out something metaphysically innocent. It is not very satisfying, of course, to be told simply that these principles must be wrong. We would like to know how and why those principles go wrong.

Without an explanation of where these principles go wrong, it may seem that Proposal #1 unjustifiably assumes too close an analogy between existence over space and existence over time. In particular, while there may well be important analogies between existence over space and existence over time, perhaps including the central 4D analogy, that the two both involve *extension* (and the concomitant having of parts), the recognition of analogies does not preclude the recognition of disanalogies. In fact, the anti-coincidence argument we developed in Section 3.2 points to a significant disanalogy, as I will next explain.²⁸

As discussed earlier, myriad humdrum data provide *prima facie* reason to accept *Same Parts* \Rightarrow *Same Futurals*. The apple *had* to fall when released; it was determined to fall, given its total situation at the time of release. If this “datum” is wrong, we need to be told how and why. It is on the basis of apparently representative cases like this that *Same Basics* \Rightarrow *Same Futurals* is accepted. The latter, together with *Same Parts* \Rightarrow *Same Basics*, which the 4Dist accepts, yields *Same Parts* \Rightarrow *Same Futurals*.

But now, let us try to find a spatial analogue to *Same Parts* \Rightarrow *Same Futurals*. To begin with, we need a notion of spatially basic properties. Let us say that a property is spatially basic if

will attest.)

²⁸ The key principle to consider in asking about disanalogies is *Same Parts* \Rightarrow *Same Futurals*. As we saw earlier, *Same Parts* \Rightarrow *Same Historicals* can be defended on its basis, given only the relatively unproblematic assumption

its instantiation at a region R depends only on events happening within R. Next, we need an analogue to futural properties. I am not sure what this would be. But to play along, let it be “northerly” properties, i.e., properties whose instantiation at R depend on what is going on at R and due north of the northernmost points in R (relative to some privileged reference frame), but not on what is going on south of R. Here is what we arrive at:

A spatial counterpart of *Same Parts* \Rightarrow *Same Futurals*:

If x and y have the same parts at a region R, then x and y have the same *Northerly* properties at R.

This is obviously silly. It gains no support whatever from the equally silly spatial counterpart of *Same Basics* \Rightarrow *Same Futurals* (i.e., *Same Spatial Basics* \Rightarrow *Same Northerlies*). Thus, while there is a *prima facie* good case for *Same Parts* \Rightarrow *Same Futurals*, there is nothing of the sort for its spatial counterpart. Perhaps the appearance of a disanalogy is misleading, but the appearance is undeniable.²⁹

Proposal #2: appeal to the rich 4D ontology. Doesn't the ontology of 4Dism *guarantee* the existence of objects violating *Same Parts* \Rightarrow *Same Futurals*? Consider Bush and his current temporal part. They share all the same parts now. But only Bush will survive and only Bush had

that any fusion-creating process could occur in reverse. So we will focus on the former principle.

²⁹ When this paper has been presented, I have often encountered the following objection: “But surely when we see fission and fusion cases in the eyes of the 4Dist, they seem far less troubling: things can partially overlap!” Eli Hirsch points out that students’ puzzlement about personal identity fission cases diminishes markedly when they are told Lewis’s solution. I agree that, intuitively, when we see fission/fusion cases in 4D they seem less problematic, but I think this intuition relies on a default assumption that sharing temporal parts is relevantly analogous to sharing spatial parts. Once we see that the sharing of temporal parts is constrained lawfully in a way that the sharing of spatial parts isn’t, the intuition, if it persists, carries less weight.

a past, and he and his current temporal part differ in futural (and historical) properties. Even if we consider only persisting objects, the principle is violated. Consider the part of Bush which consists of his past up to the present, call it *Bush**. 4Dists are committed to *Bush**, given that they are committed to Bush (given the mereological account of temporal extension). But Bush has a future while *Bush** doesn't. More violations follow if the 4Dist accepts the fusion axiom of absolute mereology (i.e., that any set of objects has a fusion *simpliciter*). The principle *Same Parts* \Rightarrow *Same Futurals* is simply dead in the water, if 4Dism is true.

I reply: hold on! No 4Dist should say that our ordinary quantifiers are wide open. They are almost always restricted to the objects that are common to 3Dists and 4Dists, to what we have vaguely called *ordinary* objects: statues, lumps, persons, cats, cells, molecules, etc. So, when the 4Dist translates an ordinary quantified statement, the quantifiers in the resulting translation must be restricted to ordinary objects.³⁰ What we need from the 4Dist, then, is a story about why the principle is false even when their quantifiers are so restricted.

To make the case for the restricted version of *Same Parts* \Rightarrow *Same Futurals*, we need the following notion of *weak* lawful determination of properties:

O is weakly lawfully determined to be F at t given that it is G at t iff: O is an ordinary G at t and the generalization *All ordinary Gs at a time are Fs at that time* is nomologically necessary.

If ordinary objects' futural properties are at all times weakly lawfully determined given their basic properties, then it follows that, for all ordinary objects x and y, if x and y are basic

³⁰ If we restrict the quantifier in *Same Parts* \Rightarrow *Same Futurals* to ordinary objects, then, in order to keep the problem set inconsistent, we must also add a premise to the effect that statues and lumps are ordinary objects. But the addition is unproblematic and so we will neglect it.

duplicates at a time t , then they are futural duplicates at t . The latter is just the restricted version of *Same Basics* \Rightarrow *Same Futurals*, which together with the restricted version of *Same Parts* \Rightarrow *Same Basics*, entails the restricted version of *Same Parts* \Rightarrow *Same Futurals*.

What is hard to see is how the 4D ontology and ideology provide any reason to deny the key move here: that an ordinary object's futural properties at a time are weakly lawfully determined given its basic properties. Of course, the 4Dist wants to solve the puzzles of coincidence, and so may argue that, if the puzzles are to have solutions, weak determination must not occur, or at least must not occur in fission cases. But to argue in *that* way is not to appeal to distinctive features of 4Dism. The 3Dist might well make the same argument, no more and no less convincingly. To repeat something mentioned in Section 3.2: if we are to give up our belief that the apple we released didn't just happen to fall but *had* to fall, given its situation at the time of release, we will need a better reason than that the truth of this belief rules out one of the most attractive solutions of the puzzles of coincidence. We need to be shown what our mistake is.

Proposal #3: appeal to kind-relativity. The 4Dist might try again: "No, No! I do not deny beliefs like the one about the apple. And I do want to show you the big mistake you're making. Put simply, we normally neglect kind-relativity. Ordinary objects' futural properties are weakly determined given its basic properties, but only relative to a kind."³¹ Proposal #3 thus denies *Same Parts* \Rightarrow *Same Futurals* and *Same Parts* \Rightarrow *Same Historicals*, but affirms the principles that result by adding *Same Kinds* to their antecedents.

Clearly, if kind properties were themselves basic properties, then appealing to kind-

³¹ Kind-relative weak determination is explainable as follows:

O is weakly lawfully determined in the kind-relative sense to be F at t given that it is G at t iff: there is some kind K such that O is an ordinary K that is G, and the generalization *All ordinary Ks that are G at a time are F at that time* is nomologically necessary.

relative determination would not help the 4Dist. The statue and the lump would be of the same kind, and so would be determined in the kind-relative sense to have the same futural properties. Similarly, if kind properties were historical, the 4Dist would still be in trouble, for then she would have to say that in statue/lump cases in which the statue and the lump share all their past temporal parts, they are of the same kind just before the flattening, and so should have the same futural properties at that time, which they don't. Rather, the 4Dist must insist that the possession of a kind property at any and all times during an object's career depends on events happening before, during, and after that time. And this is a natural view for the 4Dist to take. She does not want to count all of a statue's proper temporal parts (momentary and longer) as statues. Being a statue at a time (or equivalently at all times) is a matter of being a maximal statueishly-interrelated fusion of stages (Lewis 1976). Thus, because the statue is a proper temporal part of the lump, the lump cannot be a statue nor can the statue be a lump.

There are at least two problems with the appeal to kind-relativity. Both may have occurred to you. The first is scope limitation problem: some puzzles of coincidence involve objects of the same kind, and so cannot be regarded by the 4Dist as proper temporal parts of one another (e.g., the ship of Theseus case, and the fission/fusion cases in the literature on personal identity). So, the appeal to kind-relativity will not solve these puzzles.³² The second, and more serious, problem is that Proposal #3 is not distinctively 4D. In our statement of it none of the

³² It is noteworthy that, while 4Dists are typically happy to give an overlap treatment of the ship of Theseus and all the puzzles involving apparently coincident objects of the same kind, one is hard-pressed to find 3Dists who accept the coincidence solution in these cases. My hunch is that 3Dists find it extremely difficult to deny kind-relative determination while 4Dists think the whole problem is avoided by appeal to the mantra "partial overlap is not coincidence." For the 3Dist, no story like Rea(1997b)'s, referring to different supervenience bases for coinciding objects, can be told for coinciding objects of the same kind. For the 4Dist, partial overlap is unproblematic regardless of the kinds of objects involved (two roads can partially overlap, Siamese twins can, etc.).

distinctive ideology or ontology of 4Dism entered in. The 3Dist, too, may say that weak determination is always kind-relative and that kinds are neither basic nor historical properties.³³

A rather *ad hoc* fix to Proposal #3 is to relativize weak determination to something guaranteed to solve the problem of scope limitation: *being an ordinary object that does not share a temporal part with another ordinary object at the relevant time*. Even putting aside its ad hoc character, however, this fix solves at most the scope limitation problem. It does not solve the problem of distinctiveness. The 3Dist may, with equal plausibility, relativize weak determination to ordinary objects that are not coincident with other ordinary objects at the relevant time.³⁴

Although we cannot rule out the possibility there is some hitherto unexplored 4D proposal that avoids the shortcomings of those we have discussed, we can say that not only do

³³ As Wasserman (2002) notes, it seems no less problematic for the 4Dist to treat kinds as non-basic and non-historical than it is for the 3Dist. Where the 4Dist will say that what temporal parts an object has help to ground its kind, the 3Dist may say that what parts an object has at various times help to ground its kind.

Taking kinds to be grounded in total careers makes it hard to see how kinds can be invoked in explaining why an object has the futural properties it does. If a particular lump is a lump partly because it persists after a flattening, then it is hard to see how its being a lump can be invoked in an explanation of why it persists. See my --- for further discussion.

³⁴ The ad hoc fix amounts to giving up a picture of the world according to which how a thing is qualitatively at a certain time is explainable (deterministically or even probabilistically) in terms of how it was (if it existed) previously. This can be seen by thinking about fission cases involving things of the same kind. Suppose persons P1 and P2 divide at t. P1 ends up in body A and P2 in body B. So, at t, P1, unlike P2, is such that it will be in body A. Bodies A and B will differ qualitatively in numerous ways. Suppose A is 150 lbs, and B 180 lbs. Recall the apple. I release it, and it falls. It *had* to fall given the basic state it was in. How can we explain this? I can say: “the apple had to fall because it was basically such and such, *and* it was an apple.” But now how can we explain why P1 had to end up in a 150 lb. body? The thing can’t be done. I don’t intend this to be a devastating consequence. Even if we think that there is only one person before fission, then unless we say that somehow a person can come to have two minds, we are stuck with the choice of either saying (with Chisholm) that the original person inexplicably ended up in the 150 lb. body (rather than 180 lb. body) or saying that identity is not an essential basis for egoistic concern.

the 4Dists fail to avoid the puzzles of coincidence, but the prospects look dim for a distinctive and plausible 4D solution.³⁵

5. An Argument Against 4Dism?

I conclude with some admittedly speculative thoughts. Reflection on lawful determination of properties, I want to suggest, provides a *prima facie* reason to reject 4Dism, or if it does not quite succeed in doing *that*, it does at least help to articulate what 3Dists find so very troubling about 4Dism.

As we noted earlier, the 3Dist should not accept a plenum of stages because such a plenum leads to property correlations that demand explanation in terms of mereologically-grounded property-borrowing of the 4D kind. Sider's (2001) "argument from vagueness" for 4Dism relies on this very fact. His strategy is, very briefly, as follows. First, argue for universalism about diachronic composition on the basis of vagueness considerations. Briefly:

³⁵ Mark Moyer noted to me that this argument will not succeed unless the supervenience problem I discuss is the main problem with coincidence. He is right. But, he asks, aren't there other problems on which the 4Dist might do better? Consider this argument:

It just seems bizarre to think that two things could be in the same place at the same time. Unlike the 3Dist, the 4Dist can help us see how it isn't so bizarre: it's part-sharing! The 3Dist must see coincidence as "overcrowding," but not the 4Dist.

I think the 4Dist does not get much mileage from this argument, although I agree that the 4Dist can bring her distinctive 4D ontology to bear here. A couple comments. First, it is still bizarre, after we accept 4Dism, to see the statue/lump case as involving two persisting objects, and very bizarre to see personal identity fission cases as involving two persisting persons – even if there is a temporal-part in common. Second, for the 3Dist, ordinary objects exist exactly in certain temporally extended regions of space-time. If we had two ordinary objects existing exactly in the same such region, that would be overcrowding; but we don't have this, at least in the temporal versions of the puzzles of coincidence. When the 4Dist pins the charge of "overcrowding" on the 3Dist, she is refusing to look beyond the moments of coincidence. (It must be conceded that the language of being wholly present encourages the overcrowding charge. See extended note 1 for a discussion of the appropriateness of that language

diachronic composition cannot be vague, nor can it be metaphysically arbitrary whether it occurs, and yet it does occur, and therefore it must be universal. Second, from diachronic universalism argue, in effect, that there is a plenum of stages. And third, argue from the existence of a plenum of stages to 4Dism.³⁶

The argument from vagueness is one of the most promising arguments for 4Dism. But acceptance of its main intermediate conclusion, diachronic universalism, comes at a very high cost. It commits one to all Hirsch-style fusions constructible from a base of ordinary objects (Hirsch 1982). So, consider the Hirsch-style object, *US President*, which coincides with Washington when he is president, Adams when he is president, and so on for all past, present, and future US Presidents. It is not surprising that ordinary thought struggles to make sense of *US President* and its kin: assuming they exist, these are objects whose existence over time is lawless – nothing about their futures is fixed by the laws given their basic and historical properties, even in the kind-relative sense.³⁷ 4Dists therefore seem to be in the following unhappy dialectical position: what is arguably the best argument in favor of their view commits them to unacceptable objects.

Even without diachronic universalism, the 4Dist is stuck with the likes of Bush* (the

for formulating 3Dism.)

³⁶ Here are more details. Sider argues, on the basis of vagueness considerations, for what he calls *universalism about minimal diachronic fusion*: for any function f from times to sets of objects, there is some object y that exists at and only at the times in f 's domain and which is such that, for any $\langle t, X \rangle$ in f , y is a fusion at t of X . If this doctrine is true, then, for every object O and time t at which O exists, there is a stage that is a fusion of $\{O\}$ at t . Given Sider's definition of an instantaneous temporal part, it follows that every object has an instantaneous temporal part at every moment of its existence, which is just how he defines 4Dism. See note 8 for a discussion of whether Sider's argument establishes something worthy of the label "4Dism".

³⁷ It is hard to know what to say about the kind of *US President*, but I cannot see why its kind should be different from that of any other Hirsch-style object. [0]

proper temporal part of Bush that does not exist after the present moment). Objects like Bush* may not deserve to be classified with the likes of *US President*, but they still have Hirsch-style features. Consider Bush**, which ends a second before Bush* ends. Bush** is a thick temporal part of both Bush and Bush*. Why do Bush and Bush* survive but Bush** perish after Bush**'s last moments? All three are basic duplicates at the time, and even historical duplicates to boot.³⁸ There is no explanation of this difference in survival via the laws. Nor will the spatial analogy help: there is no parallel to lawful dynamics for existence over space.³⁹

The 4Dist will probably be unimpressed. Isn't it good enough, she might protest, to respect the lawful dynamics of *ordinary* objects, the sort of objects whose dynamics our scientific theories are used to describe? On this task, she will insist, she performs every bit as well as the 3Dist. However, the 4Dist's commitment to the claim that within the temporal boundaries of any ordinary object there reside countless objects whose dynamics are less than fully lawful will reassure 3Dists: "*That is why I am 3Dist!*" To paraphrase J.J. Thomson: objects coming and going lawlessly is a crazy metaphysic!⁴⁰

³⁸ Could the 4Dist claim that "thick" proper temporal parts of ordinary objects such as Bush* and Bush** do not inherit basic properties from stages in the way that ordinary objects do? This question is raised and examined by Katherine Hawley (2001). It is hard to see on what basis the 4Dist could deny such inheritance without denying that these thick proper temporal parts have stages as parts. But if thick proper temporal parts don't have stages as parts then in virtue of what do they persist? They would not perdure or even minimally perdure in the sense of note 6.

³⁹ See the extended note 2 for an important objection to this argument.

⁴⁰ Special thanks go to Jeremy Fantl, Mark Heller, Mark Moyer, Michael Rea, Peter Vallentyne, and an anonymous referee, all of whom provided me extensive comments on versions of this paper. I also thank Michael Della Rocca, Shelly Kagan, Jon Kvanvig, Andrew Melynk, Ted Poston, Ted Sider, Ryan Wasserman, and Paul Weirich.

Extended Notes

Extended Note 1. Not all endurantists who accept the mereological account of what it is for an object to have temporal extent will accept the “wholly present” formulation of endurantism. In particular, eternalist endurantists will not. Let me explain.

An object is wholly present (WP) at each moment of its existence iff *all its parts exist at each such moment*. Either ‘parts’ here has the absolutist reading or there is some hidden temporal relativization. Suppose an endurantist accepts the mereological account of temporal extension. Then she will not believe that objects are temporally extended (because if they are they perdure). So, for her, the only way to read ‘parts’ absolutely would be the presentist way. (Explanation: the presentist holds that temporally relativized predications of the form ‘x is F at t’, including mereological ones, are reducible and so equivalent to conditionals in which ‘F’ has no temporal parameter: ‘were t present, x would be F’ (Merricks 1994). From the perspective of presentism, then, one can reason thus: an object O exists at t just in case, were t present, O would exist; and so just in case, were t present, all of O’s parts would exist, and so just in case all of O’s parts exist at t.)

However, our endurantist needn’t be a presentist. If she is an eternalist, then she will deny that objects have parts *simpliciter*. She will therefore regard it as vacuously true to say that all of a persisting object’s parts *simpliciter* exist when it does. But persistence doesn’t consist in the satisfaction of a vacuous condition, because not every object persists over every period of time! So reading ‘parts’ absolutely in WP, the WP formulation of endurantism will be unacceptable to eternalist endurantists who accept the mereological account of temporal extension.

Suppose, on the other hand, that ‘parts’ has a hidden temporal relativization. Then our endurantist will reject the WP formulation on the grounds that the WP-condition is either vacuous or satisfiable only by objects that never change their parts. The reasoning here is as follows (borrowed from Sider 2001, pp. 63-68). There are two main candidates for the interpretation of ‘parts’ in the WP-condition – “parts the object has at *every* time of its existence” and “parts the object has at *some* time or other of its existence.” The WP-condition is vacuous on the first interpretation, and on the second, it is satisfied only by objects that never change in their parts.

I should finally mention another “more positive” account of endurance, which will serve all 3Dists equally well: objects persist and do so by having parts at each moment of their existence, where this having of parts at a time is not reducible to the having of temporal parts.

Extended note 2. Here is an important objection to our argument against 4Dism in Section 5. “Look, even if existence over space is different in the way you suggest from existence over time, the principles for diachronic composition that lead the 4Dist to accept arbitrary undetached temporal parts and arbitrary diachronic fusions have synchronic analogues that lead the 3Dist to accept arbitrary undetached spatial parts and arbitrary synchronic fusions. But now: is the temporally scattered object *US President* any more mysterious than the spatially scattered object which is the fusion of Bush and the Sears Tower? Is Bush* any more mysterious than the current proper spatial part of Bush that includes everything except his left hand?”

First off, I agree that all these objects would be mysterious. But the issue I am raising in the body of the paper is about lawful dynamics. Temporally scattered objects and arbitrary undetached temporal parts lack lawful dynamics. However, there is no *simple* argument for thinking that the same goes for their spatial counterparts. In the temporal case, we are adding things to our ontology that share temporal parts, and so which are basic duplicates at certain times without being futural duplicates at those times. By contrast, in the spatial case, we are merely adding more things to our ontology that do not coincide with other things and so do not share their basic properties with anything else. Objects that do not coincide at a time – even strange ones – will differ in basic properties of the form *having parts with such and such basic properties and standing in such and such basic interrelations*. The fusion of Bush and the Sears will therefore not have the same basic properties as anything else (assuming it is not coincident with anything else and assuming our world is nonsymmetrical). So long as coincidence is avoided, *Same Basics* \Rightarrow *Same Futurals* may be preserved.

The hard part is to say something informative about the basic and kind properties that these spatially odd objects have *without starting down the pathway that leads to accepting coincidence*. Suppose we say that the fusion of Bush and the Sears has the persistence conditions of a “mere sum,” i.e., it persists iff both Bush and the Sears persist. Why, then, isn’t there also a mere sum of all the atoms currently composing *me*? If there is, trouble seems to follow: I persist through the destruction of one of my atoms but the mere sum does not. But wouldn’t I be coincident with this mere sum, and so a basic duplicate of it? If so, *Same Basics* \Rightarrow *Same Futurals* is not preserved.

One way out for the 3Dist is to deny the mereological principles of arbitrary synchronic fusions and arbitrary undetached spatial parts. Granted, denying the latter means rejecting the mereological account of spatial extension at a time. 3Dism does not entail the truth of these principles, nor do 3D solutions to philosophical puzzles require their truth, nor do the best arguments for 3Dism rely on them. The contrast with 4Dism should be clear. It must be said, however, that denying these mereological principles will require the 3Dist to answer arguments for them (e.g., Lewis’s argument for arbitrary synchronic fusions).

However, the 3Dist might be able to accept arbitrary synchronic fusions and undetached parts without sacrificing *Same Basics* \Rightarrow *Same Futurals*. Suppose she thinks of the relevant objects as mere sums. Quite possibly, she will have to concede that I and the mere sum of my atoms are distinct objects composed by a single set of atoms. However, she has at least two options for holding on to *Same Basics* \Rightarrow *Same Futurals*. First, she may argue (as we noted in section 3.2) that I and the mere sum do not *coincide*, because I have parts that the mere sum does not. As a mere appeal to intuition, this is likely not to convince anyone. Second, and more interestingly, she may deny that things composed of the same atoms must be basic duplicates. Here Rea’s (1997b) suggestion may be helpful. As observed in note 15, one might argue that, because I and the mere sum supervene on atoms’ being arranged in different ways, I have some parts (an arm) that the mere sum doesn’t. Alternatively, the 3Dist might argue that, despite having all the same parts, difference in supervenience bases grounds a difference in basic properties. This would be to deny *Same Parts* \Rightarrow *Same Basics*. I suspect that the best defense of the coincidence view is to deny *Same Parts* \Rightarrow *Same Basics* on just these grounds. As we have seen, this strategy is unavailable to the 4Dist who understands coincidence at a time to consist in the sharing of temporal parts.

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