

## Why Four-Dimensionalism Explains Coincidence

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*Abstract:* In ‘Does Four-Dimensionalism Explain Coincidence?’ Mark Moyer argues that there is no reason to prefer the four-dimensionalist or *perdurantist* explanation of coincidence to the three-dimensionalist or *endurantist* explanation. I argue that Moyer’s formulations of perdurantism and endurantism lead him to overlook the perdurantist’s advantage. A more satisfactory formulation of these views reveals a puzzle of coincidence that Moyer does not consider, and the perdurantist’s treatment of this puzzle is clearly preferable.

### 1. Introduction

In ‘Does Four-Dimensionalism Explain Coincidence?’ Mark Moyer argues that neither the perdurantist nor the endurantist has an explanatory advantage with respect to puzzles of coincidence. Since one of the central arguments in favor of perdurantism is its purported advantage in this regard, Moyer’s conclusion – if correct – would severely undermine the case for perdurantism.

But Moyer’s conclusion is not correct. Moyer reaches this conclusion because his characterizations of endurantism and perdurantism are unsatisfactory. Given a better formulation of these positions, it becomes clear that there is a puzzle of coincidence that Moyer overlooks. This puzzle of coincidence is of particular interest to those engaged in the debate over persistence. And with respect to this puzzle, the perdurantist has a clear advantage over the endurantist.

### 2. A ‘Puzzle of Coincidence’

I have a piece of copper that exists from 9am to 10am. Suppose at 9:30am I fashion the copper into a statue. The statue exists from 9:30am to 10am, at which time both copper and statue are destroyed. This scenario appears to lead to what Moyer calls a ‘puzzle of coincidence’:

The statue and the piece of copper of which it is composed have different temporal properties... Because they have different properties, the statue must, following Leibniz’s Law, be distinct from the piece of copper. But this means we have two objects occupying the same space at the same time, which common sense tells us is impossible! Many deny some step in the reasoning just given and insist that the statue and the piece of copper are identical. Those who don’t are left with a ‘puzzle of coincidence’. [2009: 479-480]

Following Moyer, I take the ‘puzzling’ aspect of the puzzle of coincidence to be its conflict with the common-sense claim that ‘distinct objects cannot occupy exactly the same space at the same time.’ [480]

The intuition that distinct objects cannot wholly occupy the same place at the same time may seem straightforward. But there are several ways to flesh out this intuition, depending on what we mean by ‘occupy,’ ‘exactly occupy,’ and ‘coincidence.’ Moyer begins with the following characterizations [482]:

If an object **occupies** a region  $R$ , it occupies each of the points and sub-regions within  $R$ .

An object **exactly occupies** a region  $R$  *iff* it occupies every point inside  $R$  and no point outside  $R$ .

Two objects **coincide** at a time  $t$  *iff* they exactly occupy the same spatial region at  $t$ .

As Moyer points out, there are two different notions of ‘occupation.’ [482] First, there is ‘tenseless’ or ‘atemporal’ occupation. If an object *atemporally occupies* a region, then it occupies that region *simpliciter*. Second, there is ‘tensed’ or ‘temporal’ occupation, which crucially involves time. An object does not temporally occupy any region *simpliciter*; it occupies a region *relative to a time*.

The appropriately modified definitions appear below:<sup>1</sup>

#### **Atemporal occupation (occupation<sub>A</sub>)**

If an object **occupies<sub>A</sub>** a region  $R$  it occupies<sub>A</sub> each of the points and sub-regions within  $R$ .

An object **exactly occupies<sub>A</sub>** a region  $R$  *iff* it occupies<sub>A</sub> every point inside  $R$  and no point outside  $R$ .

Two objects **coincide<sub>A</sub>** *iff* they exactly occupy<sub>A</sub> the same region.

#### **Temporal Occupation (occupation<sub>T</sub>)**

If an object **occupies<sub>T</sub>** a region  $R$  at time  $t$ , it occupies<sub>T</sub> each of the points and sub-regions within  $R$  at  $t$ .

An object **exactly occupies<sub>T</sub>** a region  $R$  *iff* it occupies<sub>T</sub> every point inside  $R$  and no point outside  $R$  at  $t$ .

Two objects **coincide<sub>T</sub>** *iff* they exactly occupy<sub>T</sub> the same region at  $t$ .

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<sup>1</sup> Both perdurantists and endurantists can accept these characterizations of absolute occupation and temporal occupation. What they will disagree about is whether absolute occupation is to be defined in terms of temporal occupation, or the other way around.

### 3. Two Versions of the Puzzle of Coincidence

The atemporal and temporal notions of occupation, exact occupation, and coincidence can be used to spell out the intuitive puzzle of coincidence in different ways. And the endurantist and perdurantist responses to the puzzle of coincidence will vary depending on how the puzzle is characterized. First, the atemporal version of the puzzle:

**(P1) The Puzzle of Coincidence<sub>A</sub>:** how can the piece of copper and the statue exactly occupy<sub>A</sub> the same location?

With respect to the Puzzle of Coincidence<sub>A</sub>, perdurantists and endurantists offer the very same response: the piece of copper and the statue do *not* exactly occupy<sub>A</sub> the same location. The spatiotemporal region exactly occupied<sub>A</sub> by the piece of copper extends from 9am to 10am, while the spatiotemporal region exactly occupied<sub>A</sub> by the statue extends from 9:30am to 10am. So both the perdurantist and the endurantist agree that there is no coincidence in this case. Thus the Puzzle of Coincidence<sub>A</sub> does not arise for either one.

Second, the temporal version:

**(P2) The Puzzle of Coincidence<sub>T</sub>:** how can the piece of copper and the statue exactly occupy<sub>T</sub> the same (spatial) location at time *t*?

As Moyer argues, both perdurantists and endurantists must admit that the piece of copper and the statue exactly occupy<sub>T</sub> the same spatial location at *t*. So both are faced with the burden of ‘explaining away’ the apparent counterintuitiveness of this result.<sup>2</sup>

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<sup>2</sup> According to Moyer, this burden is easily discharged: Moyer simply denies that ‘the everyday thought that two objects cannot occupy the same location is even meant to apply to the statue and the piece of copper.’ [481] He claims that an intuitive puzzle of coincidence arises only when coinciding<sub>T</sub> objects fail to share all of their parts at *t*. Assuming that the statue and copper share all their parts at *t* (although see Johnston [1992] for a dissenting view), there is no further mystery as to how the statue and the copper coincide<sub>T</sub> at *t*. So Moyer believes that the coincidence<sub>T</sub> of the statue and copper does not give rise to any intuitively motivated puzzle of coincidence whatsoever.

There are reasons to be skeptical of Moyer’s proposed dissolution of the Puzzle of Coincidence<sub>T</sub>. Although Moyer uses the apparent coincidence of the statue and the piece of copper to motivate the intuitive worry behind the Puzzle of Coincidence<sub>T</sub>, he then denies that there is any intuitive worry at all. But if there were no intuitive worry about the coinciding<sub>T</sub> statue and copper, then there would be no intuitive puzzle concerning the statue and copper for Moyer to motivate. And there clearly *is* an intuitive worry: for how can two objects occupy the same place at the same time, and share all their parts at that time, and still be *two*?

But Moyer instead claims that the common-sense intuition against coincidence has to do with ‘cases such as people walking through walls or baseballs passing through baseball bats.’ [481] First, I doubt that there is a single common-sense intuition against coincidence; and second, it seems that *this* intuition has little to do with the issue at hand. Whether or not a person can walk

So far, we see that the perdurantist and the endurantist are in the same boat with respect to the puzzles of coincidence<sub>A</sub> and coincidence<sub>T</sub>, which is in line with Moyer's discussion. However, there is a different way of fleshing out the intuitive puzzle of coincidence – one that naturally arises when we adequately characterize the endurantist and perdurantist positions.

#### 4. Characterizing Endurantism and Perdurantism

Moyer offers the following gloss on the difference between perdurantism and endurantism:

Four-dimensionalism (or 'perdurantism' or 'temporal parts theory') views objects as stretched out in time as well as in space; it says objects have temporal parts much as they have spatial parts... Three-dimensionalism (or 'endurantism') denies such parts, saying that objects exist wholly at every moment of their existence. [479]

This is a good beginning, but it leaves much unsaid. For what does the endurantist mean when she says that objects 'exist wholly at every moment of their existence,' or alternatively, that objects are 'wholly present' at every moment they exist?

It is not uncommon to see the notion of 'wholly present' expressed in terms of 'occupation' or 'exact occupation.' Gilmore [2007], for example, explicitly takes 'wholly present' to mean the same thing as 'exactly occupy.' Hawthorne [2006] suggests a similar route, noting that 'exact occupation' must be taken as primitive.

But we cannot characterize 'wholly present' in terms of the atemporal and temporal notions of 'occupation,' 'exact occupation,' and 'coincidence' that Moyer employs. Part of what marks the difference between the perdurantist and endurantist is that they *disagree* about whether an object can be wholly present at multiple times.<sup>3</sup> As Moyer argues, however, the endurantist and the perdurantist never disagree on the facts about occupation<sub>A</sub> or occupation<sub>T</sub>, nor do they disagree on the facts about exact occupation<sub>A</sub> or exact occupation<sub>T</sub>. If we wish to maintain

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through a wall is contingent upon the laws of nature, and the place to look for an explanation is physics, not metaphysics (see Sider [2001: 141]). If this is the worry Moyer has in mind, then we are no longer concerned with the relation between part and whole or between overlap and identity; instead we are concerned with intuitions about the nomological character of our world. But this is not the issue that concerns those working on the metaphysics of persistence. For no matter what the laws of nature are like, there remains a mystery as to how distinct objects can wholly coincide.

In any case, disagreement with Moyer on this point does not threaten Moyer's main claim that neither the endurantist nor the perdurantist has any advantage when it comes to the Puzzle of Coincidence<sub>T</sub>. For these reasons, I will put aside this feature of Moyer's presentation in what follows.

<sup>3</sup> Gilmore [2007] takes this disagreement to be at the heart of the endurantist/perdurantist divide.

that there is a substantive difference between endurantism and perdurantism, then these notions cannot serve to characterize the notion of ‘wholly present.’<sup>4</sup>

Nor can we characterize ‘wholly present’ in terms of the denial of temporal parts. As Crisp and Smith [2005], Gilmore [2006: 206-207], Hawthorne [2006], Parsons [2000] and [2007], and Sider [2001: 63-68] point out, the endurantist’s denial of the perdurantist’s temporal parts does not entail that objects are wholly present at every time at which they exist.

What to do? One might give up on the notion altogether, as Sider [2001] does, and characterize endurantism simply as the denial of perdurantism. But a core part of the standard endurantist picture involves the claim that temporally extended objects are wholly present at multiple times.<sup>5</sup> And since this claim is not entailed by any other claims the endurantist endorses, a characterization of endurantism that leaves it out seems incomplete. So to fully capture the endurantist position, we must add the positive claim that objects are wholly present at every time at which they exist. Following a suggestion of Gilmore’s [2006], let us characterize endurantism as the conjunction of the following two claims:<sup>6</sup>

1. A temporally extended object is wholly present at every time at which it exists.

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<sup>4</sup> Hawthorne [2006] puts the point forcefully. If we wish to capture the endurantist’s notion of ‘wholly present,’ he says, we will need to take some notion of ‘wholly present’ or ‘exact occupation’ as primitive. Those who are unwilling to do so will not be able to make sense of many of the issues raised in discussion of persistence. Hawthorne concludes: ‘Such is the way of many foundational disputes: the framework within which one party raises questions may have no counterpart in the framework of other parties. Those of us who work with the bare-bones ‘occupation’ and those predicates that can be derived from it’ – as Moyer does – ‘will be forced to look elsewhere for interesting theses in the vicinity of disputes about three-dimensionalism.’ [104]

<sup>5</sup> Just about every characterization of endurantism given in the literature includes the claim that objects are wholly present at every moment at which they exist. For some examples, see Caplan [2005], Crisp and Smith [2005], Gilmore [2006] and [2007], Haslanger [2003], Hawley [2001: 27-30], Hawthorne [2006], Hawthorne *et al* [2004], Hudson [2006: 117] and [2007], Lewis [1986: 202] and [1994], Mellor [1981:104], Parsons [2000] and [2007], Paul [2002], Rea [1995], Simons [1987, 175], *inter alia*.

<sup>6</sup> As Gilmore demonstrates, the claim that objects have temporal parts is logically independent of the claim that objects are wholly present at every time at which they exist. One can consistently hold that every object is wholly present at every time at which it exists and also hold that every object has temporal parts. Gilmore is agnostic as to whether such a view deserves the name ‘endurantism.’ But it seems that it does not, since the denial of temporal parts is a key element of the endurantist’s position. So in order to characterize endurantism in a satisfactory manner, both claims are required.

2. It is not the case that all objects have temporal parts.<sup>7</sup>

Likewise, we may understand perdurantism as the conjunction of the following two claims:

1. All objects have temporal parts.
2. It is not the case that all temporally extended objects are wholly present at every time at which they exist.

## 5. The Puzzle of Coincidence<sub>WP</sub>

Now let's return to the topic of coincidence. The original puzzle of coincidence was this: how can distinct objects exactly occupy the same space at the same time? We've already seen two ways to disambiguate 'exactly occupy': exactly occupy<sub>A</sub> and exactly occupy<sub>T</sub>. But there is a third way to understand 'exactly occupy' – as 'wholly present.' And given the notion of 'wholly present,' we can define a new notion of 'coincidence' – call it 'wholly present coincidence' or 'coincidence<sub>WP</sub>':

Two objects **coincide**<sub>WP</sub> *iff* they are wholly present at the same place at the same time.

We now have another version of Moyer's puzzle of coincidence:

**(P3) The Puzzle of Coincidence<sub>WP</sub>:** how can the piece of copper and the statue be wholly present at the same place at the same time?

It seems that the Puzzle of Coincidence<sub>WP</sub> captures the intuitive worry behind the puzzle of coincidence at least as well as other formulations of the puzzle. Moyer claims that 'the problem of coincidence is a worry about satisfying the everyday intuition that two objects cannot occupy exactly the same location *at a time*,' which is why Moyer focuses on the Puzzle of Coincidence<sub>T</sub>. [481] But the intuitions that Moyer marshals in favor of the Puzzle of Coincidence<sub>T</sub> apply equally well to the Puzzle of Coincidence<sub>WP</sub>, since both puzzles capture the intuitive worry that distinct objects cannot coincide at the same time.

Moreover, at least some philosophers explicitly have the Puzzle of Coincidence<sub>WP</sub> – not the Puzzle of Coincidence<sub>T</sub> – in mind. According to Gilmore [2007], a puzzle of coincidence arises whenever the following principle is violated: 'It is impossible for numerically distinct material objects to coincide – that is, to be (i) wholly present in exactly the same location and (ii) composed, at

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<sup>7</sup> Some endurantists may want to admit that certain objects have temporal parts – for instance, the fusion of objects located at different times. But such endurantists will nonetheless deny the perdurantist's claim that *all* objects have temporal parts.

some level of decomposition, of all the same parts or all the same matter at the given location.’ [177-178]<sup>8</sup>

In the puzzles of coincidence presented earlier, the endurantist and the perdurantist agreed on all the facts about occupation, and so neither had an explanatory advantage over the other. In this case, however, the endurantist and the perdurantist *disagree* on the facts about ‘wholly present.’ So they offer different treatments of the Puzzle of Coincidence<sub>WP</sub>.

First, the endurantist. Suppose it is 9:30am, the time at which the piece of copper is formed into a statue. According to the endurantist, the piece of copper is wholly present at a spatial region *R* located at 9:30am. The statue is wholly present at a spatial region *S* located at 9:30am.  $R = S$ . So the piece of copper and the copper statue are wholly present at the same place at the same time. Thus endurantism yields the counterintuitive result that distinct objects *can* be wholly present at the same place at the same time.

Next, the perdurantist. Neither the piece of copper nor the copper statue is wholly present at 9:30am. Indeed, there is no time *t* at which the piece of copper is wholly present, and there is no time *t* at which the copper statue is wholly present. More generally, the perdurantist claims that distinct objects are *never* wholly present in the same place at the same time. Since the perdurantist denies that any such coincidence may occur, she does not face the Puzzle of Coincidence<sub>WP</sub>.

We can now make sense of the arguments given by Hawley [2001], Heller [1984] and [2000], and Sider [2001], *inter alia*, that perdurantism offers a better explanation of coincidence than endurantism. For the perdurantist, the Puzzle of Coincidence<sub>WP</sub> does not arise, since distinct objects never coincide<sub>WP</sub>. But the puzzle *does* arise for the endurantist, since distinct objects can coincide<sub>WP</sub>.

How might the endurantist respond to this puzzle? First, she could bite the bullet. Second, she could argue that the piece of copper and the statue do *not* coincide<sub>WP</sub>. Perhaps the endurantist will deny that there are any such things as statues and pieces of copper (as van Inwagen [1990] does). Or perhaps she will deny that objects can undergo certain sorts of change (as Chisholm [1976] does). Or perhaps she will say that the piece of copper goes out of existence when it is

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<sup>8</sup> Others appear to have the Puzzle of Coincidence<sub>WP</sub> in mind as well. Sider says that the ‘problem of how two distinct things could coincide spatially’ dissolves on the perdurantist picture because it is never the case that distinct objects are *wholly present* at the same place and time: ‘At any given time it is only a temporal part of a spacetime worm that is wholly present. Thus it is only temporal parts of Statue and Lump that are wholly present at the time of coincidence. How can these temporal parts both fit into a single region of space? Because ‘they’ are *identical*.’ [Sider 2001: 6]

fashioned into a statue (as Burke [1994] does). Or perhaps she will adopt some non-standard account of identity (as Geach [1980] or Gallois [1998] do).<sup>9</sup> But all these options have costs of one sort or another.<sup>10</sup> The perdurantist, on the other hand, does not face these worries. So the perdurantist's treatment of the Puzzle of Coincidence<sub>WP</sub> is preferable.<sup>11</sup>

One of the key divides between endurantism and perdurantism involves the notion of 'wholly present': the endurantist believes that objects are wholly present at every moment they exist, the perdurantist disagrees. If the only tools we have at our disposal are the temporal and atemporal notions of 'occupation,' 'exact occupation,' and 'coincidence' that Moyer allows, we do not have the resources to adequately state the endurantist's position.

Once we grant the endurantist the notion of 'wholly present,' an inequalitarian treatment of coincidence begins to emerge. For it seems that distinct objects cannot be wholly present at the same place at the same time – i.e. it seems that distinct objects cannot coincide<sub>WP</sub>. The perdurantist can capture this intuition, but the endurantist cannot. So when it comes to the Puzzle of Coincidence<sub>WP</sub>, the perdurantist has an advantage over the endurantist.

Which of the three puzzles of coincidence presented here best captures the intuitive puzzle of coincidence with which we began? They are not in competition for the role of *the* Puzzle of Coincidence, settled once and for all. The intuitive worry is vague and underspecified, and each formulation captures a different aspect of what is puzzling about coincidence. But there are reasons why philosophers engaged in the debate over persistence should attend to the Puzzle of Coincidence<sub>WP</sub> in particular. First, it is the puzzle that naturally arises when we take seriously the endurantist's claim that objects are wholly present at every time they exist. And second, it is the only one of the three puzzles that elicits a different response from the perdurantist than from the endurantist, and so it is the

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<sup>9</sup> The options listed are some of the ways that endurantists have attempted to avoid the puzzle of coincidence by arguing that, at time  $t$ , there is at most one object located at  $l$ . If there is at most one object located at  $l$  at time  $t$ , then there is at most one object wholly present at  $l$  at time  $t$ . Thus the same options are available to the endurantist to avoid the puzzle of coincidence<sub>WP</sub>.

<sup>10</sup> See chapter 5 of Sider [2001] for a comprehensive discussion of the costs of many of these accounts, as well as chapters 5 and 6 of Hawley [2001]. See also Hawthorne [2003] for a discussion of the problems facing non-standard accounts of identity.

<sup>11</sup> The endurantist might also attempt to 'explain away' the Puzzle of Coincidence<sub>WP</sub> by appeal to shared parts, as Moyer does with respect to the Puzzle of Coincidence<sub>T</sub>. For reasons already discussed (see fn. 2) such an explanation does little to mitigate the intuitive force of the puzzle.

only one that illuminates the different ways in which these theories treat cases of apparent coincidence.<sup>12</sup>

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<sup>12</sup> Many thanks to two anonymous referees for helpful suggestions, and to Chris Meacham for extensive comments and discussion.

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