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## FUSIONS AND ORDINARY PHYSICAL OBJECTS\*

**ABSTRACT.** In “Tropes and Ordinary Physical Objects”, Kris McDaniel argues that ordinary physical objects are fusions of monadic and polyadic tropes. McDaniel calls his view “TOPO”—for “Theory of Ordinary Physical Objects”. He argues that we should accept TOPO because of the philosophical work that it allows us to do. Among other things, TOPO is supposed to allow endurantists to reply to Mark Heller’s argument for perdurantism. But, we argue in this paper, TOPO does not help endurantists do that; indeed, we argue that anyone who accepts TOPO should reject endurantism.

### 1. INTRODUCTION

In “Tropes and Ordinary Physical Objects”, Kris McDaniel (2001) argues that ordinary physical objects are fusions of monadic and polyadic tropes. McDaniel (2001, pp. 273, 287, no. 9) calls his view “TOPO” – for “Theory of Ordinary Physical Objects”. He argues that we should accept TOPO because of the philosophical work that it allows us to do (2001, p. 274). Among other things, TOPO is supposed to allow endurantists to reply to Mark Heller’s (1990) argument for perdurantism (2001, pp. 278–282). But, we argue in this paper, TOPO does not help endurantists do that; indeed, we argue that anyone who accepts TOPO should reject endurantism.

In section 2, we present TOPO. In section 3, we explain how McDaniel uses TOPO to reply to Heller’s argument for perdurantism. But McDaniel’s reply works only if ordinary physical objects can survive the loss of some of their parts; and we argue in sections 4–7 that, given TOPO, it is hard to see how ordinary physical objects could do that if endurantism is true. In section 8, we argue that anyone who accepts TOPO should

reject endurantism, since endurantists who accept TOPO cannot explain how ordinary physical objects can gain or lose properties. The argument in section 8 is not simply a version of David Lewis's (1986, pp. 202–204) well-known argument from temporary intrinsics (that is, the argument for the claim that endurantists cannot explain how objects can gain or lose intrinsic properties); rather, the argument in section 8 is directed specifically at endurantists who accept TOPO.

## 2. MCDANIEL'S THEORY OF ORDINARY PHYSICAL OBJECTS

According to TOPO, ordinary physical objects are fusions of monadic and polyadic tropes. So understanding TOPO requires understanding three things: (i) what counts as an ordinary physical object, (ii) what fusions are, and (iii) what monadic and polyadic tropes are. Although McDaniel does not offer an account of what counts as an ordinary physical object,<sup>1</sup> he describes ordinary physical objects as “the medium-sized dry goods of our everyday experience” (2001, p. 269) and offers “tables, cars, persons, etc.” as examples (2001, p. 270). In what follows, we focus on persons.

The notion of a fusion comes from mereology, the theory of parts and wholes. Often the parthood relation is taken as basic and used to define other mereological relations.<sup>2</sup> For example, we can use the parthood relation to define the overlap relation as follows:  $x$  overlaps  $y$  if and only if there is some  $z$  such that (i)  $z$  is a part of  $x$  and (ii)  $z$  is a part of  $y$ . We can then use the parthood and overlap relations to define the composition relation as follows:  $x_1, \dots, x_n$  compose  $y$  if and only if (i)  $x_1, \dots, x_n$  are parts of  $y$  and (ii), for every  $z$  such that  $z$  is a part of  $y$ , there is some  $x_i$  (where  $1 \leq i \leq n$ ) such that  $z$  overlaps  $x_i$ . And, finally, we can use the composition relation to define the fusion relation as follows:  $y$  is a fusion of  $x_1, \dots, x_n$  if and only if  $x_1, \dots, x_n$  compose  $y$ . So to say that something is a fusion of love, law, and chimney-sweep, for example, is to say both that there is something – call it “Fred” – that has love, law, and chimney-sweep as parts and that anything that is a part of Fred has a part that is also a part of love, or law, or chimney-sweep.

Tropes are particularized properties or relations.<sup>3</sup> For example, the negative charge of *this* electron and the negative charge of *that* electron might be duplicates, but they are nonetheless different tropes. Some tropes – for example, the negative charge of this electron – are *monadic*: that is, they are particularized properties. By contrast, other tropes – for example, the trope that obtains in virtue of this electron’s and that electron’s being a certain distance apart – are *polyadic*: that is, they are particularized relations. On McDaniel’s (2001, pp. 272–274) view, monadic tropes such as mass, charge, and spin compose fundamental physical particles; various polyadic tropes obtain among these particles; and, together, fundamental physical particles and the polyadic tropes that obtain among them compose ordinary physical objects. That is, ordinary physical objects are fusions of fundamental physical particles and the polyadic tropes that obtain among those particles. Since fundamental physical particles are themselves fusions of monadic tropes, and since the parthood relation is transitive, ordinary physical objects are fusions of monadic and polyadic tropes. This is TOPO.<sup>4</sup>

### 3. HELLER’S ARGUMENT FOR PERDURANTISM

McDaniel (2001, pp. 278–282) argues that TOPO allows endurantists to reply to Heller’s (1990, pp. 2–4, 19–20) argument for perdurantism. Perdurantism and endurantism are views about how objects persist. According to perdurantism, objects persist by *perduring*: that is, objects exist over time in virtue of having temporal parts that exist at different times.<sup>5</sup> According to endurantism, by contrast, objects persist by *enduring*: that is, objects exist over time, but not in virtue of having temporal parts that exist at different times; rather, as it is often put, objects exist over time in virtue of being wholly present at different times.<sup>6</sup>

Consider the following case.<sup>7</sup> Suppose that You are a fusion of particles. Call one of those particles “Slim”. Call the fusion of all the other particles “You-Minus”. You are not now identical to You-Minus, since You have a part that You-Minus

lacks: namely, Slim. You stub your toe and lose Slim. You survive the stubbing, as does You-Minus. After the stubbing, You are identical to You-Minus, since You and You-Minus have all the same parts. But that's impossible, since You weren't identical to You-Minus before the stubbing.

Heller argues that perdurantism offers the best account of the stubbing case: You and You-Minus share a spatially maximal temporal part after the stubbing (in other words, after the stubbing You and You-Minus are completely spatially coincident); but You and You-Minus are distinct persisting objects, since You and You-Minus have different temporal parts before the stubbing. There are other ways of accounting for the stubbing case – for example, by insisting that distinct objects can have exactly the same parts at the same time, or by denying that identity is transitive – but they are all worse than perdurantism.

McDaniel (2001, pp. 279–280) replies that endurantists who accept TOPO can account for the stubbing case just as well as perdurantists can. You and You-Minus are not identical after the stubbing. You-Minus is a fusion of particles, whereas You are a fusion of particles *and* the polyadic tropes that obtain among them. So, even after the stubbing, You are not identical to You-Minus, since You have parts that You-Minus lacks: namely, polyadic tropes.

Here is a modified version of the stubbing case, one that does not allow McDaniel to offer the same reply. According to TOPO, You are a fusion of fundamental physical particles and the polyadic tropes that obtain among them. Call one of these particles “Slim”. Call the fusion of (i) all of the polyadic tropes except for those that relate Slim to the other particles and (ii) those other particles “You-Minus-Plus”. You are not now identical to You-Minus-Plus, since You have parts that You-Minus-Plus lacks: namely, Slim and all the polyadic tropes that relate it to Your other particles. You stub your toe and lose Slim. You survive the stubbing, as does You-Minus-Plus. It seems that after the stubbing You are identical to You-Minus-Plus, since You and You-Minus-Plus have all of the same parts. But that is impossible, since You were not identical to You-Minus-Plus before the stubbing.

Again, Heller would argue that perdurantism offers the best account of the modified stubbing case: You and You-Minus-Plus share a spatially maximal temporal part after the stubbing; but You and You-Minus-Plus are distinct persisting objects, since You and You-Minus-Plus have different temporal parts before the stubbing. Again, McDaniel replies that endurantists who accept TOPO can account for the modified stubbing case just as well as perdurantists can. But this time he cannot say that You-Minus-Plus survives the stubbing and that, because after the stubbing You have a part that You-Minus-Plus lacks, You and You-Minus-Plus are not identical after the stubbing. For, if You-Minus-Plus were to survive the stubbing, then You and You-Minus-Plus would have exactly the same parts.

Rather, McDaniel (2001, pp. 280–282) argues that, although You survive the stubbing, You-Minus-Plus *does not*. Slim is lost in the stubbing. Slim was not part of You-Minus-Plus before the stubbing, but the loss of Slim results in other losses after the stubbing. In particular, McDaniel (2001, p. 280) takes it to be “empirically proven” that removing even a single particle from a physical system will disturb the relations that obtain among the remaining particles, so some of the polyadic tropes that You and You-Minus-Plus shared before the stubbing no longer obtain after the stubbing.<sup>8</sup> Call one of the polyadic tropes that no longer obtains after the stubbing “Steve”. Steve is a part of You-Minus-Plus before the stubbing. But, after the stubbing, Steve no longer obtains and hence no longer exists. According to McDaniel, You-Minus-Plus cannot survive the loss of any of its parts. In particular, it cannot survive the loss of Steve. So it does not survive the stubbing.<sup>9</sup> By contrast, You survive the stubbing. It is true that Steve is a part of You before the stubbing and that Steve does not exist after the stubbing. But You can survive the loss of some of Your parts. So, unlike You-Minus-Plus, You survive the stubbing.

#### 4. MERELOGICAL ESSENTIALISM

McDaniel’s reply to Heller’s argument for perdurantism rests on two claims: first, that You-Minus-Plus cannot survive the

loss of any of its parts; and, second, that You can survive the loss of some of Your parts. Adapting terminology from Peter Simons (1987, p. 2), let us say that an object is *temporally mereologically constant* if and only if it cannot gain or lose any parts; otherwise, it is *temporally mereologically variable*. McDaniel's first claim is thus what we can call *Constancy for You-Minus-Plus*: namely, You-Minus-Plus is temporally mereologically constant;<sup>10</sup> and his second claim is thus what we can call *Variability for You*: namely, You are temporally mereologically variable.

That objects are temporally mereologically constant is a consequence of mereological essentialism, the doctrine that they have their parts essentially. Mereological essentialism has an analogous modal consequence. Let's say that an object is *modally mereologically constant* if and only if it could not (now) have had different parts; otherwise, it is *modally mereologically variable*. Mereological essentialism also implies that objects are modally mereologically constant.

Here is an argument for *Constancy for You-Minus-Plus*. Mereological essentialism is true of fusions: that is, fusions have their parts essentially. And You-Minus-Plus is a fusion. So You-Minus-Plus is temporally mereologically constant. But this is not an argument that McDaniel can endorse, at least in unqualified form, since it proves too much: in particular, it proves that *Variability for You* is false. According to TOPO, You are also a fusion. If mereological essentialism is true of fusions, then You are temporally mereologically constant, too. The problem for McDaniel is not the lack of an argument for *Constancy for You-Minus-Plus*; rather, it's the presence of an argument against *Variability for You*.

Endurantists generally agree that mereological essentialism is true of fusions.<sup>11</sup> As a result, endurantists generally accept

*Constancy for Fusions*: Fusions are modally and temporally mereologically constant.

But it seems that *Constancy for Fusions* and

*The Identity Thesis*: Ordinary physical objects are fusions.

entail

*Constancy for Ordinary Physical Objects*: Ordinary physical objects are modally and temporally mereologically constant.

Some endurantists accept The Identity Thesis and hence accept Constancy for Ordinary Physical Objects.<sup>12</sup> By contrast, other endurantists reject Constancy for Ordinary Physical Objects and hence reject The Identity Thesis.<sup>13</sup> Instead, they argue that ordinary physical objects are *constituted by*, but not identical with, their matter.<sup>14</sup> But all of these endurantists accept Constancy for Fusions; and all of them accept that Constancy for Fusions and The Identity Thesis entail Constancy for Ordinary Physical Objects.<sup>15</sup>

The Identity Thesis is obviously central to TOPO. And it seems that Constancy for Fusions and The Identity Thesis entail Constancy for Ordinary Physical Objects. But Constancy for Ordinary Physical Objects entails the negation of *Variability for You*; and McDaniel needs *Variability for You* to reply to Heller. So what is McDaniel to do? He could reject Constancy for Fusions. But Constancy for Fusions is accepted by the vast majority of philosophers, and with good reason. After all, fusions are supposed to be nothing “over and above” their parts; they are not supposed to be constituted by those parts in the way that some say that an ordinary physical object is constituted by, but not identical with, its matter. So McDaniel would need an independent argument – one that does not presuppose *Variability for You* or the negation of Constancy for Ordinary Physical Objects – against Constancy for Fusions. But McDaniel does not offer such an argument. (More on this in section 7.) So what else could McDaniel do?

## 5. WORMS AND STAGES

McDaniel could deny that Constancy for Fusions and The Identity Thesis entail Constancy for Ordinary Physical Objects. This would allow him to deny Constancy for Physical Objects and hence to accept *Variability for You*. There are two ways of denying the entailment that are familiar from the literature. But

neither of them is compatible with endurantism: one presupposes David Lewis's worm view, and the other presupposes Theodore Sider's stage view.

Let us start with the modal case. How could it be that You are modally mereologically variable, even if You are a fusion and fusions are modally mereologically constant? Lewis (1971, 1986, Chapter 4) tells us how.<sup>16</sup> On Lewis's view, ordinary physical objects are world-bound, but they have counterparts in other possible worlds. What modal properties an object has depends on what nonmodal properties its counterparts have. But there are many counterpart relations, and which counterpart relation is relevant depends on the conversational context. In a conversational context in which we use "You", one counterpart relation – a *person* counterpart relation – will be relevant; whereas in a conversational context in which we use "*f*", another counterpart relation – a *fusion* counterpart relation – will be relevant, even if You are identical with *f*.<sup>17</sup>

If TOPO is true, then in the actual world You are a fusion *f* of certain fundamental physical particles and the polyadic tropes that obtain among them. Consider a world *w* in which counterparts of all of Your particles with the exception of Slim are arranged more or less as they are in the actual world. Now consider the fusion *f*<sup>\*</sup> of all of these *w*-particles and the polyadic tropes that obtain among them. (Even if Slim exists in *w*, Slim is not one of these *w*-particles.) *f*<sup>\*</sup> is a *person* counterpart of You. So You could have had different parts than You actually have. But *f*<sup>\*</sup> is not a *fusion* counterpart of *f*. And no fusion that does not have as parts counterparts of all of Your particles and the polyadic tropes that obtain among them is a fusion counterpart of *f*. So *f* could not have had different parts than it actually has, even though You are *f*.

In the temporal case, how could it be that You are temporally mereologically variable, even if You are a fusion and fusions are temporally mereologically constant? That is, how could *Variability for You* be true (and hence *Constancy for Ordinary Physical Objects* be false) even if *The Identity Thesis* and *Constancy for Fusions* are true? Again, Lewis (1976, 1986, pp. 202–204) tells us how. On Lewis's view, ordinary physical

objects are spacetime *worms*: that is, they have temporal parts that exist at different times.

On this view, You have a temporal part that exists at some time  $t$  before the stubbing. If TOPO is true,<sup>18</sup> then Your temporal part at  $t$  is a fusion  $f$  of the temporal parts at  $t$  of certain fundamental physical particles and the polyadic tropes that obtain among them. Consider the fusion  $f^*$  of the temporal parts at  $t^*$  of (i) the fundamental physical particles other than Slim that overlap  $f$  and (ii) the polyadic tropes that obtain among those particles at  $t^*$ . There are parts of You – namely, Slim and the polyadic tropes that relate it to Your other particles – that overlap  $f$  but that do not overlap  $f^*$ .  $f$  and  $f^*$  are related *personwise*: that is, they are related in such a way as to be parts of a persisting *person*. This persisting person is You. You can lose parts, because Your temporal part at  $t$  – namely,  $f$  – overlaps Slim and the polyadic tropes that relate it to Your other particles, whereas Your temporal part at  $t^*$  – namely,  $f^*$  – does not. But  $f$  and  $f^*$  are not related *fusionwise*: that is, they are not related in such a way as to be parts of a persisting *fusion*. (They are related in such a way as to be parts of a persisting person, and a persisting person is a fusion, but that is not what is meant when it is claimed that they are not parts of a persisting fusion.) No fusion of temporal parts that did not overlap Slim and the polyadic tropes that relate it to Your other particles could be related fusionwise to  $f$ . So no fusion can lose parts, even though at  $t$  You are a fusion: namely,  $f$ .

Sider (2001, pp. 188–208) offers a different explanation, one that makes the temporal case more like the modal one.<sup>19</sup> On Sider’s view, ordinary physical objects are time-bound (that is, they are momentary *stages*), but they have counterparts at other times. What temporal properties an object has depends on what nontemporal properties its temporal counterparts have. But there are many temporal counterpart relations, and which temporal counterpart relation is relevant depends on the conversational context. In a conversational context in which we use “You”, one temporal counterpart relation – a *person* temporal counterpart relation – will be relevant; whereas in a conversational context in which we use “ $f$ ”, another temporal

counterpart relation – a *fusion* temporal counterpart relation – will be relevant, even if You are *f*.

If TOPO is true,<sup>20</sup> then at time *t* You are a fusion *f* of certain fundamental physical particles and the polyadic tropes that obtain among them. Consider a time *t*\* at which temporal counterparts of all of Your particles with the exception of Slim are arranged more or less as they are at *t*. Now consider the fusion *f*\* of all of these *t*\*-particles and the polyadic tropes that obtain among them. (Even if Slim exists at *t*\*, Slim is not one of these *t*\*-particles.) *f*\* is a *person* temporal counterpart of You. So You can lose parts. But *f*\* is not a *fusion* temporal counterpart of *f*. And no fusion that does not have as parts temporal counterparts of all of Your particles and the polyadic tropes that obtain among them at *t* is a fusion temporal counterpart of *f*. So *f* cannot lose parts, even though You are *f*.

By adopting either Lewis's worm view or Sider's stage view (together with Sider's temporal counterpart theory of *de re* temporal claims), McDaniel could thus explain how You can be temporally mereologically variable, even if You are a fusion and fusions are temporally mereologically constant. That is, McDaniel could explain how *Variability for You* can be true (and hence Constancy for Ordinary Physical Objects can be false), even if The Identity Thesis and Constancy for Fusions are true. But, unfortunately, this does not help endurantists reply to Heller's argument for perdurantism. For neither the worm view nor the stage view is compatible with endurantism. The worm view and the stage view are primarily views about what ordinary physical objects *are* (on the worm view, ordinary physical objects are worms; whereas, on the stage view, ordinary physical objects are stages), but they have consequences for how ordinary physical objects *persist*. On the worm view, ordinary physical objects have different temporal parts at different times, so they are not wholly present at any one time. So, contrary to endurantism, ordinary physical objects cannot exist over time in virtue of being wholly present at different times. And, on the stage view, ordinary physical objects are time-bound, so they are wholly present at at most one time. So, again contrary to endurantism, ordinary physical objects can-

not exist over time in virtue of being wholly present at different times.

#### 6. THE INCONSTANCY OF *DE RE* MODAL AND TEMPORAL REPRESENTATION

McDaniel cannot avail himself of either Lewis's worm view or Sider's stage view; but it does not follow that there is no other way for him to deny that The Identity Thesis and Constancy for Fusions entail Constancy for Ordinary Physical Objects. And indeed there are other ways of denying that entailment.<sup>21</sup>

In the modal case, what allows You to be modally mereologically variable, even if You are a fusion and fusions are modally mereologically constant is what Lewis (1986, p. 248) calls the *inconstancy* of *de re* modal representation. There is one world,  $w$ , such that (1)  $w$  represents You as existing without having Slim as a part and (2)  $w$  does not represent the fusion  $f$  as existing without having Slim as a part, even though (3) You are  $f$ . Given (3), for (1) and (2) to be true it must be the case that the sort of representation that (1) is about is different than the sort of representation that (2) is about. And, on Lewis's view, these sorts of representation are indeed different: (1) is about a sort of representation that is tied to one counterpart relation (namely, a *person* counterpart relation); whereas (2) is about a different sort of representation, one that is tied to a different counterpart relation (namely, a *fusion* counterpart relation). Given the sort of representation that is tied to the person counterpart relation,  $w$  represents You as existing without having Slim as a part in virtue of containing a person counterpart of You that exists without having (a counterpart of) Slim as a part; and, given the sort of representation that is tied to the fusion counterpart relation,  $w$  does not represent  $f$  as existing without having Slim as a part, since  $w$  does not contain a fusion counterpart of You that exists without having (a counterpart of) Slim as a part. But, as Lewis (1986, pp. 260–261) argues, counterpart theory is not the only view that allows for the inconstancy of *de re* modal representation: it turns out

that you do not even need to be a modal realist (in Lewis's sense) to allow for such inconstancy.

In the temporal case, what allows You to be temporally mereologically variable, even if You are a fusion and fusions are temporally mereologically constant, is what we can call the inconstancy of *de re* temporal representation. There is one time,  $t^*$ , such that (1)  $t^*$  represents You as existing without having Slim as a part and (2)  $t^*$  does not represent the fusion  $f$  as existing without having Slim as a part, even though (3) You are  $f$ .<sup>22</sup> Given (3), for (1) and (2) to be true it must be the case that the sort of representation that (1) is about is different than the sort of representation that (2) is about. And, on Sider's view, these sorts of representation are indeed different: (1) is about a sort of representation that is tied to one temporal counterpart relation (namely, a *person* temporal counterpart relation); whereas (2) is about a different sort of representation, one that is tied to a different temporal counterpart relation (namely, a *fusion* temporal counterpart relation). Given the sort of representation that is tied to the person temporal counterpart relation,  $t^*$  represents You as existing without having Slim as a part in virtue of containing a person temporal counterpart of You that exists without having (a temporal counterpart of) Slim as a part; and, given the sort of representation that is tied to the fusion temporal counterpart relation,  $t^*$  does not represent  $f$  as existing without having Slim as a part, since  $t^*$  does not contain a fusion temporal counterpart of You that exists without having (a temporal counterpart of) Slim as a part. But, if (as Lewis argues) counterpart theory is not the only view that allows for the inconstancy of *de re* modal representation, then we should expect that temporal counterpart theory is not the only view that allows for the inconstancy of *de re* temporal representation either. (Indeed, Lewis's worm view also allows for such inconstancy.<sup>23</sup>) This suggests that there might be a way for McDaniel to deny that The Identity Thesis and Constancy for Fusions entail Constancy for Ordinary Physical Objects – without adopting Sider's stage view (and perhaps Lewis's worm view either).

But what McDaniel needs is not just any way of denying that The Identity Thesis and Constancy for Fusions entail Con-

stancy for Ordinary Physical Objects; rather, what he needs is a way of denying that entailment that is compatible with endurantism. (Otherwise, TOPO does not help endurantists reply to Heller's argument for perdurantism.) In the modal case, Lewis (1986, pp. 261–263) argues that there is one view that does *not* allow for the inconstancy of *de re* modal representation: namely, modal realism *with overlap*. The reason is simple: with modal realism with overlap, *de re* modal representation works by identity, and there is nothing inconstant about identity. For example, a world  $w$  represents that You exist without having Slim as a part by containing something that is *identical* with You and that does not have Slim as a part; and  $w$  represents that a fusion  $f$  exists without having Slim as a part by containing something that is *identical* with  $f$  and that does not have Slim as a part. So, if You are  $f$ , then  $w$  cannot represent that You exist without having Slim as a part without thereby representing that  $f$  exists without having Slim as a part. As McDaniel (2004) himself argues elsewhere, modal realism with overlap is the natural analog in the modal case of endurantism in the temporal case.<sup>24</sup> Just as modal realism with overlap does not allow for the inconstancy of *de re* modal representation, endurantism does not allow for the inconstancy of *de re* temporal representation either. Again, the reason is simple: with endurantism, *de re* temporal representation works by identity, and there is nothing inconstant about identity. For example, a time  $t^*$  represents that You exist without having Slim as a part by containing something that is *identical* with You and that does not have Slim as a part; and  $t^*$  represents that a fusion  $f$  exists without having Slim as a part by containing something that is *identical* with  $f$  and that does not have Slim as a part. So, if You are  $f$ , then  $t^*$  cannot represent that You exist without having Slim as a part without thereby representing that  $f$  exists without having Slim as a part. If what is needed to deny that The Identity Thesis and Constancy for Fusions entail Constancy for Ordinary Physical Objects is a view that allows for the inconstancy of *de re* temporal representation, then – even if Sider's stage view or Lewis's worm view is not the only way of allowing for the inconstancy of *de re* temporal representation –

there is still reason to think that endurantists *cannot* deny that entailment.<sup>25</sup>

## 7. SPECIAL AND INTERESTING KINDS

TOPO is committed to The Identity Thesis. To reply to Heller's argument, McDaniel needs to accept *Variability for You* and hence to deny Constancy for Ordinary Physical Objects. If McDaniel does not deny that Constancy for Fusions and The Identity Thesis entail Constancy for Ordinary Physical Objects, then he must deny Constancy for Fusions. McDaniel (2001, pp. 281–282) says that, if  $x$  is a fusion, then there is a presumption that mereological essentialism is true of  $x$ , but this presumption is defeasible. In particular, it is defeated if  $x$  is an ordinary physical object. You-Minus-Plus and You are both fusions. So there is a presumption that mereological essentialism is true of You-Minus-Plus and You. But You are an ordinary physical object, whereas You-Minus-Plus is not. So the presumption that mereological essentialism is true of You is defeated, whereas the presumption that mereological essentialism is true of You-Minus-Plus is not. As a result, You are temporally mereologically variable, whereas You-Minus-Plus is temporally modally constant. So *Variability for You* and *Constancy for You-Minus-Plus* are true.

Whatever the merits of this argument as an argument for *Variability for You* and *Constancy for You-Minus-Plus*, it is not an argument against Constancy for Fusions, since it simply assumes that Constancy for Fusions is false, at least in unqualified form. The argument assumes that mereological essentialism is not true of some fusions – namely, those that are ordinary physical objects – and then explains why mereological essentialism is true of You-Minus-Plus but not of You: namely, because You are an ordinary physical object, whereas You-Minus-Plus is not. But what needs to be explained is precisely why mereological essentialism is not true of those fusions that are ordinary physical objects. What is it about being an ordinary physical object in virtue of which mereological essen-

tialism is not true of those fusions that are ordinary physical objects?

McDaniel's argument for Constancy for You-Minus-Plus assumes that You-Minus-Plus is not an ordinary physical object, and he defends that assumption (2001, pp. 281–282). On his view, not every fusion of monadic and polyadic tropes is an ordinary physical object. To be an ordinary physical object, a fusion “must fall under an interesting or special kind” (2001, p. 281). You fall under the special and interesting kind *person*, so You are an ordinary physical object (and hence mereological essentialism is not true of You). By contrast, You-Minus-Plus does not fall under a special or interesting kind, so it is not an ordinary physical object (and hence mereological essentialism is true of it). But what is it about something's falling under a special or interesting kind in virtue of which mereological essentialism is not true of those fusions that are ordinary physical objects?

There is an answer to be had; but it is not one that endurantists can have. On the worm view, that You fall under the special and interesting kind *person* is what allows us to say that the temporal parts  $f$  and  $f^*$  are parts of the same persisting *person* (namely, You), even though they are not parts of the same persisting *fusion*. This, in turn, is what allows us to say that You can survive the loss of Slim and other parts, even though You are a fusion at  $t$  and no fusion can survive the loss of parts. On the stage view (combined with temporal counterpart theory), that You fall under the special and interesting kind *person* is what allows us to say that a fusion at another time is Your *person* temporal counterpart, even though it is not a *fusion* temporal counterpart of the fusion  $f$  that is You. This, in turn, is what allows us to say that You can survive the loss of Slim and other parts, even though You are  $f$  and  $f$  cannot survive the loss of parts.<sup>26</sup>

#### 8. THE PUZZLE OF CHANGE

To reply to Heller's argument for perdurantism, McDaniel assumes *Variability for You* and hence needs to reject

Constancy for Ordinary Physical Objects. But it turns out that *anyone* who accepts TOPO – friends and foes of endurantism alike – should reject Constancy for Ordinary Physical Objects. TOPO assumes some theory of tropes, and one of the virtues of a theory of tropes is that it explains the relation between objects and their properties. For example, on a theory of tropes, an object has a property only if the relevant monadic trope is a part of that object.<sup>27</sup> If a change in an object's properties requires a change in its parts, then Constancy for Ordinary Physical Objects doesn't imply merely that ordinary physical objects cannot gain or lose any parts; it also implies that ordinary physical objects cannot gain or lose any properties. But ordinary physical objects can gain or lose properties. So, assuming that anyone who accepts TOPO accepts the trope-theoretic account of what it is for an object to have a property, anyone who accepts TOPO should deny Constancy for Ordinary Physical Objects. It is no wonder, then, that McDaniel (2001, p. 286) counts it as a virtue of TOPO that it avoids Roderick Chisholm's (1976) "global mereological essentialism".

TOPO is committed to the Identity Thesis. And it seems that The Identity Thesis and Constancy for Fusions entail Constancy for Ordinary Physical Objects. So anyone who accepts TOPO should deny either Constancy for Fusions or the claim that The Identity Thesis and Constancy for Fusions entail Constancy for Ordinary Physical Objects. Constancy for Fusions is intuitively plausible. So anyone who accepts TOPO should deny that The Identity Thesis and Constancy for Fusions entail Constancy for Ordinary Physical Objects. But, as we have argued, it is hard to see how to do that without accepting some view that is incompatible with endurantism. So anyone who accepts TOPO should reject endurantism.<sup>28</sup> Whether this is something to be said in favor of, or against, TOPO is a separate question.

#### NOTES

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<sup>1</sup> He says: “I do not think I can do it!” (2001, p. 270).

<sup>2</sup> See, for example, Lewis, 1991, pp. 72–74.

<sup>3</sup> See, for example, Campbell, 1990; Bacon, 1995.

<sup>4</sup> For precursors, see Williams, 1953, pp. 8–10, 1963, pp. 603–605; Lewis, 1986, pp. 64–68; Ehring, 2001.

<sup>5</sup> In addition to Heller, 1990, see, for example, Lewis, 1986, pp. 202–204. (Sider (2001) describes himself as a perdurantist, but on his view the objects that perdure aren’t ordinary physical objects; rather, they are fusions of ordinary physical objects. See Merricks, 2003. See section 5 below for more on Sider’s view of ordinary physical objects.)

<sup>6</sup> See, for example, Thomson, 1983; van Cleve, 1986; Simons, 1987; van Inwagen, 1990a, 2000. In addition to defending endurantism (in McDaniel, 2001) from Heller’s argument against it, McDaniel (2003b) elsewhere defends endurantism from Barker and Dowe’s (2003) argument against it.

<sup>7</sup> This sort of case has a long history: compare van Inwagen’s (1981) case of Descartes and D-minus; Geach’s (1980) case of Tibbles and Tib; and, before that, Chryssipus’s case of Dion and Theon (see Burke, 1994).

<sup>8</sup> McDaniel further suggests (2001, pp. 280–281) that it’s *metaphysically* impossible to remove a single particle from an “integrated functional unit” such as a person without changing at least some of the relations that obtain between the remaining particles, on the grounds that, if it were really so easy to remove the particle, this would provide evidence that the particle was not a part of the functional unit in the first place. We suspect that pursuing this line of argument would lead to further problems for TOPO; but, since we’re prepared to grant for the sake of argument that the removal of Slim would result in the loss of some polyadic tropes, we won’t explore the issue further here.

<sup>9</sup> For an independent argument for this sort of conclusion, see Burke, 1994.

<sup>10</sup> Assuming that You-Minus-Plus can’t gain any parts either.

<sup>11</sup> See, for example, Wiggins, 1979; van Cleve, 1985, p. 596, 1986, p. 147; Simons, 1987, pp. 1–2, 361–362. (But van Inwagen is an exception. See note 15 below.) Wiggins (1979) offers an argument for the claim that mereological essentialism is true of fusions. For a criticism of Wiggins’s argument, see van Cleve, 1985, pp. 590–591. Van Cleve (1985, pp. 596–597) offers his own argument for that claim. But his argument assumes the following uniqueness principle:

(UN) If  $x_1, \dots, x_n$  compose  $y$  at  $t$  and  $x_1, \dots, x_n$  compose  $z$  at  $t'$ , then  $y = z$ . And McDaniel (2001, p. 282) claims to be suspicious of UN (although he does not explicitly argue against it). On the rejection of UN, see Kazmi, 1990, pp. 237–243.

<sup>12</sup> See, for example, van Cleve, 1986, pp. 147–152. Van Cleve (1986, pp. 147–149) accepts that mereological essentialism is true of sums and artifacts, but he wants to deny that mereological essentialism is true of living things and persons (1986, pp. 149–152). He says that denying this “turns out to be

trickier than one might expect” (1986, p. 149). He argues that Locke’s (1689) and Wiggins’s (1979) attempts fail, but he does not offer a new way of pulling off the trick.

<sup>13</sup> See, for example, Wiggins, 1979; Simons, 1987, esp. 1–2, Chapters 5 and 7, pp. 361–362. Simons concludes that many ordinary physical objects are not fusions, at least according to classical extensional mereology.

<sup>14</sup> See also, for example, Thomson, 1983, 1998; Johnston, 1992; Zimmerman, 1995; Baker, 1997, 2000. McDaniel is no friend of constitution theories; see McDaniel, 2003a, pp. 270–272.

<sup>15</sup> As McDaniel has pointed out in correspondence, van Inwagen is an exception: he is an endurantist (see van Inwagen, 1981, 1990a, 2000); he thinks that organisms are fusions and hence accepts some version of The Identity Thesis (see van Inwagen, 1990b); he rejects mereological essentialism for organisms and hence rejects Constancy for Ordinary Physical Objects (see van Inwagen, 1981, 1990b); and, since he thinks that all fusions (that aren’t simples) are organisms (see van Inwagen, 1990b) and rejects mereological essentialism for organisms, he presumably also rejects Constancy for Fusions.

But it is not clear that van Inwagen’s example helps McDaniel avoid Constancy for Ordinary Physical Objects. For one thing, van Inwagen doesn’t argue against Constancy for Ordinary Physical Objects; rather, he just assumes that organisms are temporally mereologically variable (see van Inwagen, 1990b, p. 6). And, for another, he argues elsewhere that what he calls “the Doctrine of Arbitrary Undetached Parts” entails that objects are temporally mereologically constant (see van Inwagen, 1981). The Doctrine of Arbitrary Undetached Parts is a consequence of Unrestricted Composition. (Unrestricted Composition is a principle of classical mereology that states that for any objects  $x_1, \dots, x_n$  there is an object  $y$  – namely, the fusion of  $x_1, \dots, x_n$  – such that  $x_1, \dots, x_n$  compose  $y$ . See Lewis, 1991, p. 74.) So, if van Inwagen’s argument is sound, then Unrestricted Composition also entails that objects are temporally mereologically constant. And McDaniel (2001, pp. 272, 282–283) accepts Unrestricted Composition. So, if van Inwagen’s argument is sound, then McDaniel is committed to the claim that objects are temporally mereologically constant and hence (unless objects are modally mereologically variable) must accept Constancy for Ordinary Physical Objects; at least he must reject *Variability for You*, which he needs to reply to Heller. (But van Inwagen’s argument is based on the same sort of case as Heller’s, so McDaniel can reply to van Inwagen’s argument in much the same way as he replies to Heller’s.)

<sup>16</sup> See also Noonan, 1991.

<sup>17</sup> One might object that any account of *de re* modality that appeals to counterpart relations that shift depending on which of two names for a single object is being used is no account of *de re* modality at all (since, in a sense, the modality is connected more with the names than with the object itself). One

might thus object to Lewis's counterpart theory of *de re* modality; but in this paper we don't directly address the merits of Lewis's view.

<sup>18</sup> McDaniel (2001, pp. 283–286) reformulates TOPO to apply specifically to worms. (On the reformulation, ordinary physical objects are fusions of temporal parts *and cross-temporal relations* – such as immanent causation – between those temporal parts. See also McDaniel 2001, pp. 288–289, no. 34.) Alternatively, we could keep TOPO as it is – ordinary physical objects are fusions of fundamental physical particles and the polyadic tropes that obtain among them – and allow that those particles and tropes might be worms.

<sup>19</sup> See also Hawley, 2001.

<sup>20</sup> Although McDaniel reformulates TOPO to apply specifically to worms (see note 18), he doesn't reformulate TOPO to apply specifically to stages. We could keep TOPO as it is – ordinary physical objects are fusions of fundamental physical particles and the polyadic tropes that obtain among them – and allow that those particles and tropes might be stages.

<sup>21</sup> Thanks to an anonymous referee for raising this point.

<sup>22</sup> It might sound odd to speak of times as representing that  $x$  is  $F$ , since after all, if you are an eternalist (see note 24), you will not think that times are abstract representations. But notice that Lewis is happy to talk of worlds as representing that  $x$  is  $F$ ; and he does *not* think of worlds as abstract representations. Eternalists who are also endurantists might think that there is a further oddity in saying that a time  $t$  represents that  $x$  is  $F$ , since they will think that  $x$  itself (rather than some temporal counterpart of  $x$  or something else that represents  $x$ ) exists at  $t$ . But notice that this is no odder than those who believe in modal realism with overlap (see below in the main text) saying that a world  $w$  represents that  $x$  is  $F$ , since they will think that  $x$  itself (rather than some counterpart of  $x$  or something else that represents  $x$ ) exists in  $w$ . We continue to use “representation”, because we want to emphasize the symmetry between the modal and the temporal cases; but, as will be clear from the discussion below in the main text, nothing turns on the choice of terminology here.

<sup>23</sup> On Lewis's view, (1) is about a sort of representation that is tied to one continuity relation (namely, a *person* continuity relation); whereas (2) is about a different sort of representation, one that is tied to a different continuity relation (namely, a *fusion* continuity relation). Given the sort of representation that is tied to the person continuity relation,  $t^*$  represents You as existing without having Slim as a part in virtue of containing a temporal part that is related personwise to Your temporal part at  $t$  and that does not have a temporal part of Slim as a part; and, given the sort of representation that is tied to the fusion continuity relation,  $t^*$  does not represent  $f$  as existing without having Slim as a part, since  $t^*$  does not contain a temporal part that is related fusionwise to Your temporal part at  $t$  and that does not have a temporal part of Slim as a part.

<sup>24</sup> More precisely, modal realism with overlap is the natural analog in the modal case of endurantism combined with eternalism in the temporal case. (Eternalism is the claim that past, present, and future times all exist *simpliciter*; all are equally real. In this sense, eternalism is the natural analog in the temporal case of modal realism in the modal case.)

<sup>25</sup> Denying eternalism (see note 24) won't help endurantists here. What prevents endurantists from allowing for the inconstancy of *de re* temporal representation is that representation works by identity, something that even endurantists who are not eternalists are committed to.

<sup>26</sup> Strictly speaking, of course, what the worm view and the stage view explain is not why Constancy for Fusions is false; rather, it is why Constancy for Fusions and The Identity Thesis do not entail Constancy for Ordinary Physical Objects.

<sup>27</sup> McDaniel (2001, pp. 272–273) denies the corresponding claim for relations: namely, that some objects stand in a relation only if the relevant polyadic tropes are parts of those objects. But he accepts the claim for properties. He takes a change in an object's properties to require a change in its parts. He says: "we can understand the qualitative change of an object as simply consisting of that object's gaining, losing, or rearranging its parts" (2001, p. 272). McDaniel's use of "simply consisting of" suggests that he accepts a stronger claim: namely, that an object has a property *if and only if* the relevant monadic trope is a part of that object. But in correspondence McDaniel has denied the stronger claim. Although he accepts that an object has a property *only if* the relevant monadic trope is a part of that object, he rejects the converse: namely, that an object has a property *if* the relevant monadic trope is a part of that object. Consider two incompatible monadic tropes (for example, positive and negative charge tropes). According to Unrestricted Composition (see note 15), there is a fusion of those tropes. The converse claim entails that the fusion has incompatible properties. But that's impossible. So the converse claim must be false.

<sup>28</sup> Incidentally, if anyone who accepts TOPO should reject endurantism, then another of McDaniel's arguments for TOPO might be undermined. McDaniel (2001, pp. 282–283) argues that accepting TOPO allows classical mereologists to reply to van Inwagen's (1990b) argument against Unrestricted Composition (see note 15), since TOPO entails the negation of one of van Inwagen's premises: namely, that all of the atoms (and polyadic tropes that obtained among them) that composed me ten years ago still exist. But, independently of TOPO, rejecting endurantism (and accepting perdurantism) also allows classical mereologists to reply to van Inwagen's argument, since perdurantism entails the negation of another of van Inwagen's premises: namely, that for any organism (and not just a proper temporal part thereof) at any time there are some atoms (and polyadic tropes) that compose that organism at that time. Thanks to McDaniel for pointing this out.

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