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TROPES AND ORDINARY PHYSICAL OBJECTS

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ABSTRACT. I argue that a solution to puzzles concerning the relationship of objects and their properties – a version of the 'bundle' theory of particulars according to which ordinary objects are mereological fusions of monadic and relational tropes – is also a solution to puzzles of material constitution involving the alleged co-location of material objects. Additionally, two arguments that have played a prominent role in shaping the current debate, Mark Heller's argument for Four Dimensionalism and Peter van Inwagen's argument against Mereological Universalism, are shown to be unsound given this version of the bundle theory.

I. INTRODUCTION

Both puzzles of material constitution and puzzles concerning the relationship between objects and their properties have received a deserved share of the attention of philosophers. In this paper, I shall argue that a particular solution to the latter puzzles is also a novel solution to the former ones. I will operate on the assumption that the physical world is a world of tropes.

Ultimately, all that there is to the physical world is the distribution of particular qualities across space at times, and 'bundles' of those qualities at times, some of which are ordinary physical objects, i.e., the medium-sized dry goods of our everyday experience.

This picture of the world has become popular enough among contemporary analytic metaphysicians to warrant the claim that ironing out the details of this picture is a viable research program.[1] This paper is a considered attempt to further this research program by proposing a new theory concerning the nature of ordinary physical objects that presupposes its central tenets. Briefly, the theory that will be explored in this paper is that ordinary physical objects are mereological fusions of monadic and polyadic tropes. Typically, trope theorists claim that ordinary objects are in some sense constructed out of the more basic elements, the tropes. However,

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the nature of this construction has never been agreed on; I assume that it is mereological. The theory advocated here differs from its predecessors in one other dramatic respect: not only does it countenance mereological fusions of polyadic and monadic tropes, but it also *identifies* ordinary physical objects with some of those fusions.

In the next section, I provide a representative sample of a theory of tropes for consideration. Afterwards, I discuss a series of puzzles of material constitution and show how resourceful the theory to be discussed is in solving these puzzles. Finally, I provide a version of the theory of tropes that should be acceptable to those philosophers who endorse four-dimensionalism, which should demonstrate the versatility of this research program.

I don't presume to have knockdown arguments for the positions that will be discussed. Moreover, I will not argue that the trope-theoretic solution to the puzzles of material constitution is inherently more plausible than the current solutions available in the literature. Instead, I hope to contribute to the general case for a trope-theoretic ontology by showing that it has additional philosophical resources not yet appreciated by most philosophers. Consequently, if my arguments are sound, the case for a trope-theoretic ontology is weightier than it has previously been estimated to be.

One more thing before we begin. I shall frequently make use of the phrase, 'ordinary physical object' throughout this essay but I shall not offer an analysis of it. I don't think I can do it! But I assume that my audience understands what I mean by it; ordinary physical objects are the tables, cars, persons, etc., of our common-sense ontology.

II. A THEORY OF TROPES

What are these things that have been called 'tropes', 'abstract particulars', 'individual accidents', or 'property instances'? First and foremost, they are properties. I won't attempt a formal explication of the concept of a property, but roughly, properties are qualities or features of an object or objects (relations are treated here as a special kind of property). Tropes are not 'facts' or 'states of affairs' in the interesting, metaphysician's senses of those terms, i.e., they are not *complexes* made out of a particular substance and a universal.

Tropes are properties, but they are also particulars; that is, they are non-repeatable entities, neither platonic nor immanent universals.

Since there are many different versions of the theory of tropes, each with its own adherents, advantages, and difficulties, a particular version of the theory of tropes will be made available for the reader to consider. Nothing turns on whether the tropes are sparse or abundant or whether there must be an underlying substratum for the tropes to inhere in. Still, it's useful to have a particular theory to focus on; the details can be argued about later.[2]

First, on the version of trope theory endorsed in this paper, the monadic tropes have both spatial and temporal location. The theory I am proposing identifies ordinary physical objects with mereological fusions of tropes; so since ordinary physical objects are located in space and time, at least some of their parts must be located in space and time.[3]

Second, on the version of trope theory endorsed in this paper, the tropes are sparse: not every meaningful predicate has a bundle of tropes as its semantic content. This feature of the theory is the probably the most negotiable; little hangs on whether the tropes are sparse.[4] Most contemporary advocates of the theory of tropes have embraced a sparse theory. Moreover, I do believe that the theory of ordinary physical objects that will be explicated shortly is more plausible when embedded in a sparse theory of tropes.

However, if we do embrace a sparse theory of tropes then it seems that the job of determining what tropes there are is best occupied by empirical scientists and not by philosophers. Following the lead of current science, it is suggested that there are the various monadic tropes of mass, charge, spin, flavor, etc.[5]

Third, there are relational tropes in addition to monadic tropes. Just as monadic tropes are particular properties, relational tropes are particular relations. These relational tropes, or instances of relations, or polyadic tropes as they will henceforth be called, are real objects; they are things that we can legitimately (objectually) quantify over. However, they are in some sense not ontologically on a par with monadic tropes, for it is possible for some monadic tropes to exist without any polyadic tropes existing, while it is not possible for any polyadic tropes to exist without the relation that they are tropes of

obtaining between some bundle of monadic tropes. Polyadic tropes always inhere between bundles of monadic tropes.

Just as the job of determining what monadic tropes there are is best left to the empirical scientists, so too is the job of determining what polyadic tropes there are. At this point in time, it is reasonable to suggest that there are the relational tropes of the various attractive forces, spatial distances, and perhaps causation. Do polyadic tropes have spatial location as well as temporal location? I remain agnostic on this question.

Finally, physical reality consists in nothing more than tropes and fusions of tropes. No underlying substratum is required for tropes to inhere in; tropes are substance-free.

We now address the question of how physical objects fit into this scheme: they are fusions of monadic and polyadic tropes. This is an attractive answer since the part-whole relation is reasonably well understood. Consequently, we can understand the qualitative change of an object as simply consisting of that object's gaining, losing, or rearranging its parts.

Is it the case that for any collection of tropes, there is a thing that is the fusion of the members of that collection? That is, does unrestricted composition (UC) obtain?[6] I believe that this is the case, but I won't argue for that claim here. Instead, I suggest that we adopt this particular view about composition as a simplifying assumption. If the version of trope theory outlined above can solve problems that the advocate of UC faces, then it can obviously solve the problems facing advocates of a less permissive mereology.

Given that concrete particulars are simply bundles or mereological fusions of properties, can we analyze away the variably polyadic predicate '*x1*, . . ., *xn* instantiate(s) *y*' with a suitable variably polyadic mereological predicate? Unfortunately, it seems that we cannot do this in any straightforward manner.[7] For consider a possible world that contains two particles at some distance from each other and suppose for the sake of this example the only properties possessed by these particles are their charges and masses. How many objects exist in this world according to UC? Let's call the two particles *P1* and *P2*, the two tropes of charge *C1* and *C2*, the two tropes of mass *M1* and *M2*, and the spatial relation obtaining between the two particles, *S*. According to UC, there are 2^5-1 objects

in this possible world, the largest being the mereological fusion of the two particles *P1* and *P2*, which are the fusions of *C1* + *M1* and *C2* + *M2* respectively, and *S*. Note that although *P1*, *P2* instantiate *S*, *S* is not a part of *P1* or *P2*, and nor is *S a part of the fusion P1* + *P2*. The fusion of *P1* and *P2* is a *proper* part of the object that is the fusion *P1* + *P2* + *S*. Whenever a polyadic trope obtains between some objects, there is a mereological sum that the polyadic trope is a part of, but *it is never a part of the sum of the objects that it obtains between*; instead, the polyadic trope is always a part of a larger sum that has as a proper part the sum of the objects between which it obtains.

Given that, in this ontology, the fundamental physical particles that are the concern of professional physicists are fusions of tropes of the appropriate charge, mass, etc., that are co-located, with what objects should ordinary physical objects be identified with? Our standard, scientifically informed picture of the physical world tells us that ordinary physical objects are composed of fundamental physical particles (which according to the theory under consideration are themselves nothing more than fusions of tropes) arranged in the appropriate fashion. The standard picture is very plausible, but perhaps it is subtly mistaken.

This may sound strange. If the ordinary objects that we believe in are not fusions of particles, then what are they? According to the theory being proposed for consideration, ordinary physical objects are the mereological fusions of fundamental physical particles[8] and the polyadic tropes inhering in them. Let's call this theory, the theory of ordinary physical objects that we are considering, *TOPO*.[9]

I admit that TOPO is counter-intuitive; we don't tend to think that the particular obtaining of a relation between objects that are parts of ourselves are additional parts of ourselves. But given that polyadic tropes really do exist and we allow unrestricted fusionings of monadic tropes, there is no non-arbitrary reason why we should not allow mixed fusions of polyadic and monadic tropes (or even fusions whose ultimate parts are only polyadic tropes). Since we do permit such fusions, then we should at least grant that the mereological fusion of particles plus the instances of the relations that obtain between them, i.e., the polyadic tropes that inhere in those particles, are at least equally good candidates for being the objects

of our common sense ontology as the bare fusions of the particles alone. Given this, if adopting the picture that I am proposing has the philosophical resources to provide novel solutions to several metaphysical puzzles of material constitution that are otherwise quite problematic, we have a reason to endorse TOPO.

III. APPLICATIONS OF TOPO TO PUZZLES OF COINCIDENT MATERIAL OBJECTS

Consider a simple puzzle of material constitution. Let 'Hulk' name some arbitrarily selected fusion of physical particles. Let the particles that compose Hulk be widely scattered across the planet, but let them compose nothing that we would be interested in. When we think about Hulk in the abstract, concentrating only on the fact that it is a mereological fusion of particles and ignoring its other characteristics, it seems that as long as the particles that compose Hulk continue to exist, Hulk will exist.

Due either to some cosmic quirk or divine intervention, the particles that composed Hulk rapidly converge on the Earth's surface in the appropriate fashion to constitute a living human organism. Since these particles are arranged in the appropriate fashion for constituting a living human organism,[10] they do constitute a living human organism, who we shall name 'Bruce'. Call the instant of Bruce's coming into existence '*t*'. At *t*, does Hulk still exist? If Hulk continues to exist at *t*, is Hulk identical with Bruce, since it seems that they share all of the same parts at *t*?

Remember, prior to *t*, Hulk was just a scattered fusion of particles. At times leading up to *t*, Hulk presumably continued to exist, becoming less scattered as *t* approached. We feel pressured to claim that at *t* a brand new object with the following features comes into existence: it is composed of the same parts that composed Hulk 10^{-500} of a second before *t*, in nearly the same arrangement as they were at that time, and yet is not identical to Hulk and in fact *replaces* Hulk. In a sense, Bruce would be responsible for Hulk's demise.[11] But, to put it mildly, this is rather implausible.

On the other hand, the claim that Bruce is identical to Hulk is also far-fetched. If Bruce is Hulk, then Bruce was once a widely scattered object whose parts displayed no discernible unity. Moreover, it

seems that we would have to say the same thing about each of ourselves, which is absurd.

We could claim that at *t* both Hulk and Bruce exist, but if they do then they seem to have the same parts at that time. How could two admittedly non-identical objects nevertheless be made out of exactly the same material atoms at the same time?

The difficulty can be summarized as follows:

(1) Hulk exists at *t*.
(2) Bruce exists at *t*.
(3) Hulk is not identical to Bruce since Hulk has historical features that Bruce lacks.
(4) Hulk is identical to Bruce since Hulk is a fusion of the same particles at *t* that Bruce is a fusion of at *t*.

TOPO offers a neat solution. Since Bruce is an organism, the arrangement of the particles that are currently parts of Bruce are relevant to the fact that Bruce exists and is an organism. How the particles are arranged is determined by what relations are instantiated by the particles; that is, by what polyadic tropes inhere in those particles. The appropriate polyadic tropes come into existence at *t*. According to TOPO, these polyadic tropes are parts of Bruce at *t*. However, they are not parts of Hulk at *t*. Hulk continues to exist at *t*, but Hulk is not identical to Bruce; Hulk is merely a proper part of Bruce at *t*. Hence, (4) is false.

It is part of the nature of the ordinary physical objects that we care about to be such that the relations that obtain between the particles that are parts of them matter. How these relations matter is captured by TOPO. We have strong intuitions that mereological fusions of particles can survive the scattering of their parts to the wind while ordinary physical objects cannot. Moreover, ordinary physical objects require specific relations to obtain between their parts; mere fusions of particles do not. TOPO provides theoretical support for these intuitions, for TOPO provides a plausible way to deny that the class of ordinary physical objects is a sub-class of the class of mere mereological fusions of particles.

After *t*, is Hulk co-located with Bruce? If polyadic tropes are not spatially located, it might seem that Hulk is. However, since Bruce has parts that are not located in the spatial region occupied by Hulk (in virtue of those parts not being spatially located at all!),

Bruce is not, strictly speaking, co-located with Hulk. This sort of situation might provide grounds for thinking that polyadic tropes do have spatial location; I leave that judgement up to the reader.

Admittedly, there are co-located objects in this ontology. For example, an electron is composed of tropes of mass, negative charge, spin, etc., co-located at a single point in space at a time. Additionally, other objects are co-located at that point as well, e.g., the fusion of the mass and negative charge of the electron, the fusion of the mass and spin of the electron, etc. I suggest that co-located objects of this sort aren't really objectionable. It's not co-location per se that should be thought of unfavorably by those who deny the possibility of completely overlapping yet non-identical objects; it's complete coincidence of parts and not complete coincidence of spatial location that is objectionable.

TOPO offers a unique solution to similar problems involving the alleged coincidence of non-identical objects. Consider the following version of the classic Lump/Statue puzzle.[12] In front of us stands a gold statue, Stan, and a fusion of gold atoms shaped statue-wise, Gerald. Although every spatial region that is filled by a proper part of Gerald is filled by a proper part of Stan,[13] we cannot claim that Stan is Gerald, for Gerald has modal properties that Stan doesn't. For example, Gerald can survive being flattened while Stan cannot. However, by mereological extensionality, a theorem of temporally relativized classical mereology, for any time *t*, and for any objects *x* and y, if there is some object *w* that is a proper part of *x* at *t* then for any *z* if *z* is a proper part of *x* at *t* if and only if *z* is a proper part of *y* at *t*, then *x* is identical to *y*.[14] So, either temporally relativized classical mereology is false or Stan or Gerald has a proper part at *t* that is not had by the other.

Our current difficulty can be summarized as follows:

(1) Stan exists at *t*.

(2) Gerald exists at *t*.

(3) Stan is not identical to Gerald since Stan has modal features that Gerald lacks.

(4) Stan is identical to Gerald since for any time *t*, Stan is a fusion of the same particles at *t* that Gerald is a fusion of at *t*.

We needn't surrender temporally relativized classical mereology (at least not on this ground). For if TOPO is true, Gerald is a mere proper part of Stan, a mere fusion of every particle that is a part of Stan. However, Stan is the fusion of Gerald and all of the polyadic tropes that inhere in every part of Gerald. Since Stan has parts that Gerald lacks and we can generalize from this case, we can maintain a distinction between ordinary physical objects and the fusions of their particles. Hence, again, (4) is false.

Note that TOPO solves versions of this puzzle in which both Stan and Gerald are present at exactly the same times; even Four Dimensionalism is powerless against this puzzle of material constitution, forcing most advocates of temporal parts to embrace some version of contingent identity.[15] This is a heavy price to pay.

It might be objected that TOPO's solution to this problem of coincident material objects assumes that mere lumps of matter are not ordinary physical objects. But, according to my imaginary objector, lumps of matter (such as Gerald) are ordinary physical objects and thus should also have (if TOPO is correct) the polyadic tropes that inhere between them as parts as well. But then TOPO does not have a solution to this puzzle of coincident material objects because the same bundle of tropes composes Gerald and Stan at each time they exist.

There are two ways that an advocate of TOPO could respond to this objection. First, the defender of TOPO might simply (and plausibly) deny that lumps, heaps, etc., really are anything over and above the aggregates of particles that we might loosely say constitute them. I don't think our intuition that the aggregate of particles that (speaking loosely) constitutes a lump of clay has modal properties that differ from those of the lump of clay that is constituted by the aggregate are anywhere near as strong as our intuition that the statue constituted by the lump of clay has different modal properties than the lump of clay which constitutes the statue. Consequently, if an advocate of TOPO must identify the class of mere lumps of matter with the class of mere aggregates of particles, this is not a heavy bullet for her to bite.

A second possible response available to the advocate of TOPO is to locate lumps of matter somewhere in the middle of the mereological spectrum between mere aggregates and the more robust

objects that we care about by identifying lumps of matter with fusions of particles and some of the polyadic tropes that inhere in them. On this proposal, aggregates of particles are proper parts of lumps of matter that are in turn proper parts of the more robust ordinary physical objects that we care about.[16]

IV. TOPO AND THREE-DIMENSIONALISM

There is another reason to endorse TOPO available for those philosophers who endorse a particular view about how objects persist through time, Three Dimensionalism (3Dism).[17] According to 3Dism objects persist through time by being wholly present at each instant at which they exist. This view is to be contrasted with Four Dimensionalism (4Dism),[18] according to which objects persist through time by having a temporal part at each moment they are present. Mark Heller, a staunch advocate of Four Dimensionalism, has recently argued that we must either reject 3Dism, or accept some other even more unpleasant alternative.[19] Given TOPO, Heller's argument is unsound.

Heller claims that the following is an exhaustive list of our unpleasant alternatives.[20]

(1) there is no physical object that is identical to myself[21]
(2) there is no object that occupies the space currently occupied by myself except for a single particle at the periphery of my right foot[22,23]
(3) no object can survive the loss of a part[24]
(4) there can be two non-identical objects that share all of the same parts at the same time[25,26]
(5) the identity relation is not transitive[27]
(6) 4Dism obtains

According to Heller (6) is the least unpleasant of the options available to us. So, we should accept (6).

Heller's argument will be stated in the first person. Assume for reductio the conjunction of the denials of each of (1)–(6). Not (6), so 3Dism is true. Not (1), so I exist and am a physical object. Not (2), so there is an object that occupies the space currently filled by myself except for a single particle at the periphery of my right

foot, 'Lefty'. According to Heller (while operating on the denial of 4Dism), the relationship between Lefty and myself prior to *t* can be characterized thus: I am the mereological fusion of Lefty and the undetached particle (at the times prior to *t*).

Consider this: at *t* I stub my right toe, which causes me some distress. Additionally the particle on the periphery of my right foot flies from the rest of me. (No other particles are lost.) Since the loss of that particle cannot affect the existence of Lefty (how could it?), Lefty still exists after *t*. So:

(A) The thing that, before *t*, is Lefty is the same thing as the thing that, after *t*, is Lefty.

But since we are still operating under the assumption that (3) is false, I still exist.

(B) The thing that, after *t*, is Kris, is the thing that, before *t*, is Kris.

Since we deny (4):

(C) The thing that, before *t*, is Lefty, is the thing that, after *t*, is Kris.

Here's why. Given ∼(4), there cannot be two non-identical physical objects that share all of the same parts at *t*. But, since Lefty still exists after t, and Kris still exists after t, they share all of the same parts (according to Heller). Given ∼(5), identity is transitive, so we are led to conclude:

(D) The thing that, before *t*, is Lefty, is the thing that, before *t*, is Kris.

Premise (D) follows from (B) and (C) and the transitivity of identity. But, prior to *t*, I'm not Lefty; Lefty was one of my proper parts. So:

(E) The thing that, before *t*, is Lefty, is not the thing that, before *t*, is Kris.

But the conjunction of (D) and (E) is a contradiction! So, it seems we must accept one of the unpalatable options (1)–(6). Where has this argument gone wrong?

Let's look again at my injury, this time under the lens of TOPO. According to Heller, if 4Dism is false then if I exist after *t*, I have all

of the same parts after *t* that I had prior to *t* minus the now detached particle. Given TOPO, this is false, for there were polyadic tropes inhering in the various particles that were my parts prior to *t* and the then undetached particle that no longer do inhere in them after *t*; those polyadic tropes were also my parts prior to *t*. Moreover, after *t* new polyadic tropes inhere in the particles that are my parts after *t*; these polyadic tropes are also parts of me after *t*.[28]

Is Lefty destroyed at *t*? It isn't plausible that Lefty is, since Lefty's parts are untouched; no intrinsic change of interest occurs to Lefty. However, we can deny that Lefty is the best candidate for being me after *t*. If TOPO is correct then the best candidate for being me after *t* is the mereological fusion of Lefty and all the polyadic tropes that inhere in the particles that are parts of Lefty after *t*. That object isn't Lefty, since Lefty is a mere fusion of particles. So, although both Lefty and I exist after *t*, (C) is false.[29]

We aren't out of the woods yet. Call the thing that is the mereological fusion of all my particles minus one in my left foot but plus all of the various polyadic tropes inhering in those particles prior to *t*, Lefty*. Heller should claim that prior to *t* I am the fusion of Lefty* plus the undetached particle and the polyadic tropes inhering in the particles that constitute Lefty at that time. At *t*, I stub my toe, and the undetached particle becomes detached. Does Lefty* survive this event? If Lefty* does survive, then, since I also survive this change, it seems that I become Lefty*. But, two objects can't ever become one.

Given TOPO we have the grounds to deny Lefty* survives after *t*. First, it's not possible to remove a single particle from a complex physical system without disturbing what relations obtain between the various particles that remain in that system; I take this to be empirically proven. Given this, the removal of a single particle from a complex physical system like myself changes what spatial and causal relations obtain between those particles that are still parts of me.

Moreover, it seems to me that the scenario envisioned by my possible objector is not even *metaphysically* possible. What exactly is it that my imaginary objector is claiming? Suppose that you are told that it is possible to remove a single particle from an integrated functional unit (such as a living being like yourself) without

changing at all what relations obtain between the remaining particles left in the system. It seems to me then that you would have good grounds for thinking that the particle that is allegedly part of the functional unit is in fact *not* a part of the functional unit, because it is so easily removed. Functional units have a teleological structure; necessarily, each part of a functional unit must be intricately interrelated with every other parts of the functional unit. If an element of an alleged teleological system can be removed as easily as my objector would have us believe then we shouldn't think that the system containing the element is teleologically interrelated; the element is merely dead weight, performing no functional work towards the ends of the system. Consequently, I am led to suspect that there is a deep conceptual incoherence in the scenario envisioned by my possible objector. At the very least, we have no reason to believe such a scenario is possible.

Where does this leave Lefty*? We have seen that not all of Lefty*'s parts immediately prior to *t* still exist at *t*. If we are willing to countenance an intuitive mereological essentialism for arbitrary undetached parts, then we have good grounds to deny that Lefty* still exists at *t*. Consequently, we do have a reason to claim that Lefty* does not survive, and thus safely dodge Heller's alleged contradiction.

I can imagine someone objecting to this solution as follows. Lefty* is a fusion of polyadic and monadic tropes, not a mere fusion of particles. So, why is it the case that Lefty survives my loss of a particle and Lefty* doesn't? Lefty* is a fusion of polyadic and monadic tropes and is consequently more like an ordinary physical object than Lefty. So, why does mereological essentialism hold for Lefty*?

I reply as follows. Being a fusion of polyadic and monadic tropes is a necessary condition for being an ordinary physical object, but it is not a sufficient condition. A second necessary condition for being an ordinary physical object that Lefty* fails to satisfy is that ordinary physical objects must fall under an interesting or special *kind*. There is no interesting or special kind that Lefty* falls under. Lefty* is a mere arbitrary undetached part and hence the presumption to ascribe mereological essentialism to Lefty* is not overruled by the fact that Lefty* has some polyadic tropes as parts. Mereolog-

ical essentialism holds for Lefty as well, but Lefty survives because Lefty does not lose any parts whereas Lefty* does.

V. TOPO AND UNRESTRICTED COMPOSITION

Some philosophers have attempted to solve puzzles involving coincident material objects by denying existence of one of the putative objects. For example, Peter van Inwagen affirms (2) from the previous section:

(2) there is no object that occupies the space currently occupied by myself except for a single particle at the periphery of my right foot

According to van Inwagen, the only composite material objects are living organisms. Thus he can deny that two distinct objects become identical at a later time since, e.g., Lefty never existed in the first place. However, an advocate of TOPO is not forced to deny what van Inwagen denies, namely Unrestricted Composition (UC). Since there are good reasons to endorse UC, this is a substantial advantage for TOPO.

What of van Inwagen's argument against UC recently published in his brilliant book *Material Beings*?[30] Let's see how it fares under the scrutiny of TOPO.[31]

(1) I exist and I existed ten years ago.
(2) I am an organism, and I have always been an organism.
(3) Every organism is composed of (some) atoms (in the chemical sense) or other at every moment of its existence.
(4) Consider any organism that existed ten years ago; all of the atoms that composed it ten years ago still exist.
(5) Consider any organism that exists now and existed ten years ago; none of the atoms that now compose that organism is among those that composed it ten years ago.
(6) If Universalism is true, then for any collection of objects, the *xs*, they cannot ever compose two non-identical objects either successively or simultaneously.
∴ Hence, Universalism is false.

Thankfully, premise (1) is true. I am suspicious of both (2) and (6), but I won't challenge them. However, if TOPO is correct, then

(3), (4), and (5) are wedded to the false presupposition that there are atoms that compose me.

To say that the members of some collection of objects, the *xs*, compose some *y*, is to claim that each of the *xs* are parts of *y*, that no two of the *xs* overlap, and that every part of *y* overlaps at least one the of the *xs*. If I have a part that is distinct from every one of the atoms that are parts of me, then those atoms don't compose me. Given TOPO I do have many parts distinct from the atoms that are parts of me, namely, the various polyadic tropes inhering in the atoms. So, (3), (4), and (5) are false. Given TOPO, van Inwagen's argument is unsound. Can van Inwagen's argument be salvaged?

(3*) Every organism is composed of (some) atoms (in the chemical sense) and the polyadic tropes inhering in them at every moment of its existence.

(4*) Consider any organism that existed ten years ago; all of the atoms and the various polyadic tropes inhering in them that composed it ten years ago still exist.

(5*) Consider any organism that exists now and existed ten years ago; none of the atoms and the various polyadic tropes that inhere in them tbat compose it now are among those that composed that organism ten years ago.

(1), (2), (3*), (4*), (5*), and (6) entail the conclusion that UC is false. Furthermore, both (3*) and (5*) seem to be true. However, (4*) is obviously false, for none of the relations that obtained between the atoms that were parts of me ten years ago now obtain between those atoms (most likely, at the current time, those atoms are literally miles apart). So, none of the polyadic tropes that inhered in those atoms still exist. Given TOPO, the revised version of van Inwagen's argument is unsound.

VI. TOPO AND FOUR-DIMENSIONALISM

Although TOPO provides the philosophical resources to undermine a popular argument for 4Dism,[32] TOPO can be accommodated to a four-dimensionalist setting easily, providing even the 4Dist with surprising philosophical power. In this section I will provide a formal definition of 4Dism, explicate a four-dimensionalist version

of TOPO, and provide evidence that a four-dimensionalist version of TOPO is superior to standard 4Dism.

Roughly, 4Dism is the thesis that objects that persist through time are not wholly present at each instant at which they exist. Instead, such persisting objects are partially present in virtue of having a temporal part at each instant at which they exist. 4Dism may be stated as follows:

(4Dism): Necessarily, for any *x* and for any two non-empty non-overlapping sets of times *t1* and *t2* whose union is the time span of *x*, there is an object *x1* whose time span is *t1* and an object *x2* whose time span is *t2*, and *x* is the mereological fusion of *x1* and *x2*.[33]

On standard 4Dism, fundamental physical particles are not mereological simples; at least, not if they persist for any period of time. Instead, on standard 4Dism, instantaneous temporal parts of fundamental physical particles are mereological simples. On a four-dimensionalist TOPO picture, even these are mereologically complex. Instead of lacking mereological structure, instantaneous temporal parts of fundamental physical particles are mereological fusions of instantaneous point masses, instantaneous charges, etc., which are co-located at the same space-time points. The ordinary physical objects of our common sense ontology are then taken to be mereological fusions of temporal slices of fundamental physical particles and the polyadic tropes that inhere in them. Since, given 4Dism, relations can obtain between objects that do not exist at the same time, polyadic tropes inhering in the temporal parts of a persisting ordinary physical object (such as a table or a person) are also parts of that object, although they may not be temporal parts of it.

Four-dimensionalist TOPO (*4DTOPO*) can now be stated:

(4DTOPO): Necessarily, for any ordinary physical object *x* and for any two non-overlapping non-empty sets of times, *t1* and *t2*, whose union is the time span of *x*, there is an object *x1* whose time span is *t1* and there is an object *x2* whose time span is *t2* such that *x* is the fusion of *x1* and *x2* and any instances of cross-temporal relations[34] that obtain between any collection of objects whose fusion is a part of *x*.

4DTOPO is not faced with the philosophical puzzles that 4Dism alone cannot solve. Consequently, I claim 4DTOPO provides a viable alternative for philosophers committed to 4Dism who also do not wish to commit themselves to counterpart theory.

To see that this is the case, let's consider the standard 4Dist solution to typical puzzles of co-location. Before me is a lump of clay that I promptly shape into a statue. Let's call the statue 'David', the lump of clay 'Lewis', and the moment that David comes into existence '*t*'. Presumably, Lewis survives being shaped into a statue, for changing the shape of a mere lump of clay cannot destroy that lump. But Lewis cannot be identical to David, for Lewis has modal properties that David doesn't; for example, Lewis can survive being shaped into a ball, whereas David cannot. But it seems that David and Lewis share all of the same parts at t, so how can they fail to be identical?

Given 4Dism, although David and Lewis share all of the same parts at *t* (since to share all of the parts at a time is simply to have the same temporal part that is exactly located at that time), they do not share all of the same parts *simpliciter*. Since Lewis came into existence some time prior to David, Lewis has temporal parts that David does not. Since Lewis has parts that David does not, we arrive at the happy conclusion that Lewis is not identical to David.

4Dism provides an elegant solution to this version of the puzzle of co-location. However, 4Dism unadorned is unable to solve versions of this puzzle involving alleged co-located entities with identical time spans. Imagine that God creates a clay statue *ex nihilo*. *Ipso facto* God creates a lump of clay. This statue suffers no qualitative change until it is annihilated by God moments later. Since the time span of the lump is identical to the time span of the statue, the 4Dist cannot claim that the lump of clay has temporal parts not had by the statue. Still, the 4Dist must claim that the lump is not identical to the statue, because the lump has modal properties that the statue lacks. Consequently, unadorned 4Dism is refuted by this version of the puzzle of co-location.

Typically, 4Dist have supplemented 4Dism with counterpart theory as a way of avoiding this puzzle.[35] Counterpart theory is complex and admittedly counter-intuitive. I suspect that many 4Dists wish that there were another option.

There is. The 4Dist can help herself to 4DTOPO. What should an advocate of 4DTOPO say about the version of the puzzle of colocation in which the lump of clay and the statue have the same time span? First, that since what polyadic tropes inhere in the instantaneous temporal parts of the fundamental physical particles that are parts of ordinary physical objects such as statues are tied to the identities of such objects, we have grounds for claiming that they are also parts of such objects. The lump of clay is a mere fusion of the instantaneous temporal slices of the fundamental physical particles that are parts of the statue. The statue is something over and above the lump; it is the fusion of the lump and of all the various polyadic tropes that inhere in all of the parts of the lump. Consequently, since the lump of clay is a mere proper part of the statue we are led to correctly conclude that the lump of clay is not identical to the statue.

Given the difficult metaphysical commitments of counterpart theory, I suggest that philosophers committed to some version of 4Dism should supplement 4Dism with 4DTOPO and not counterpart theory.[36]

VIII. CONCLUSION

Many philosophers already embrace the majority of TOPO's more esoteric metaphysical commitments; both the bundle theory of particulars and the theory of particular properties have long and distinguished histories. For these philosophers, embracing TOPO is no bullet for them to bite since TOPO fits in naturally with propositions already accepted by them.

TOPO is admittedly strange, but is TOPO objectionably strange? Look at TOPO's competitors:

(1) contingent identity[37]
(2) temporary identity[38]
(3) relative identity[39]
(4) indeterminate identity[40]
(5) global mereological essentialism[41]
(6) four-dimensionalism[42]
(7) anti-essentialism[43]
(8) the postulation of ambiguities in modal predication[44]
(9) embracing a restriction on composition[45] (although TOPO is not committed to unrestricted composition)

(10) acceptance of bizarre persistence conditions for material objects[46]
(11) denying mereological extensionality[47]

It's clear from a brief glance at this list that TOPO is no stranger than its competitors. TOPO deserves its chance to be explored further.[48]

NOTES

[1] Other philosophers pursuing this research program are John Bacon, Keith Campbell, D.C. Williams, and to a lesser degree, D.M. Armstrong (1989, 1997) and David Lewis (1983b, 1986a).

[2] The essential feature of the theory that will be presented is that ordinary physical objects have relational tropes as parts; all else is negotiable. On the various versions of trope theory, see Armstrong (1989), Bacon, Campbell, and Loux.

[3] There is a second reason to locate tropes in space and time that is independent of considerations of problems of material constitution. Some trope theorists have argued that tropes are suitable to play the role of the relata of the causal relation. Causal explanations often invoke the properties of the objects that do the causing, e.g., protons interact with electrons in the way that they do because of the positive charge of the proton and the negative charge of the electron. This provides us with a prima facie reason to directly assign causal powers to the properties themselves, which in turn provides us with a strong reason to claim that the tropes that do the causing are located in space and time.

[4] But see footnote #15.

[5] This list is not intended to be an exhaustive list of what fundamental physical properties there are.

[6] On UC, see Hudson, Leonard and Goodman, Lewis (1986a) and (1991), and van Cleeve.

[7] I thank an anonymous referee for helpful discussion on this matter.

[8] Recall that fundamental physical particles are also mere fusions of monadic tropes.

[9] For the curious reader, 'TOPO' is an acronym for 'Theory of Ordinary Physical Objects'.

[10] For the purposes of this example, I'm ignoring the claim that the historical features of an object are also relevant to determining whether that object counts as a living human organism.

[11] See Burke and Rea (forthcoming).

[12] This puzzle made its first appearance in Gibbard. I suspect that it has not made its last appearance here.

[13] In what follows the temporal relativizations on the part-hood relations are left implicit.

[14] On temporally relativized classical mereology and other interesting variations, see Simons.

[15] See Gibbard, Lewis (1983a), (1986a), and van Inwagen (1981), (1990b).

[16] There is a third possibility far more radical then the two solutions just mentioned. We might think that the existence of a statue requires the existence of an artist. Moreover, in order for some object to be a statue, certain relations must obtain between the statue and the artist. This is in turn means that certain polyadic tropes must inhere between the statue and the artist. If we really insist on a three-fold distinction between aggregates of particles, lumps of clay, and statues, we can have it as follows. As before, aggregates of particles are mere fusions of particles and lumps of matter are fusions of the particles and all of the polyadic tropes that inhere between the particles. But, on this third suggestion, statues are fusions of lumps of matter and those polyadic tropes that obtain between the lumps of matter and the artist which make it the case that (speaking loosely) the lump of matter constitutes the statue. This solution strikes me as implausible, and it may require the abandonment of a sparse theory of properties, but it is a third possibility that I leave for the reader to consider.

[17] On 3Dism, see Simons, Thomson, van Cleeve, and van Inwagen (1981) and (1990b).

[18] See Lewis (1986b) and Sider.

[19] See Heller.

[20] Perhaps Heller would not claim that (6) is an *unpleasant* alternative.

[21] On (1), see Unger.

[22] On (2), see Markosian (forthcoming) and van Inwagen (1990a).

[23] Note that Heller assumes that Lefty is a mere fusion of particles.

[24] On (3), see Chisholm.

[25] In Heller's original argument, option (4) was that there are two-non identical co-located objects. Given my earlier claim that co-location per se is unproblematic, and that what is objectionable is the denial of mereological extensionality, I have taken the liberty of rewriting Heller's argument to reflect this.

[26] On (4), see Simons and Baker.

[27] On (5), see Geach (1967) (in Rea, 1997).

[28] Were some of these polyadic tropes parts of Lefty either before *t*? No, for in Heller's scenario, Lefty was stipulated to be a mere *fusion* of particles; if any of the polyadic tropes that obtained between the particles that were part Lefty had also been parts of Lefty, then Lefty would *not* be a *fusion* of particles. Instead, Lefty would be a mere *proper part* of some fusion of particles + polyadic tropes.

[29] It should now be obvious what TOPO's solution to the Tibbles/Tib paradox is. On the Tibbles/Tib paradox, see Wiggins.

[30] See van Inwagen (1990a).

[31] Again, the temporal relativizations on the part-hood relations are left implicit.

[32] Presented earlier in section IV.

[33] This definition of Four Dimensionalism is borrowed from the excellent Sider.

[34] I suggest that one important relation that obtains between the earlier temporal parts of an ordinary physical object and its later temporal parts is the relation of immanent causality. Immanent causal relations are what guarantee that temporal parts of ordinary physical objects are qualitatively similar to their immediate successors; it is because of immanent causation that my later temporal parts

resemble my earlier temporal parts. On 4DTOPO, each immanent causal relation trope that obtains between temporal parts of a persisting ordinary physical object is a part of that persisting object.

[35] See Lewis (1983a, 1986b).

[36] Or any version of the contingent identity thesis.

[37] See Lewis (1983a, 1986a).

[38] See Myro.

[39] See Geach (in Rea, 1997).

[40] See Parsons.

[41] See Chisholm.

[42] See Heller, Lewis (1986a), and Sider.

[43] See Quine.

[44] See Noonan.

[45] See van Inwagen (1990a).

[46] See Burke (1994) and Rea (forthcoming).

[47] See Baker and Simons.

[48] I have benefited from helpful comments by Bruce Aune, Lynne Rudder-Baker, Jake Bridge, Neil Feit, Chris Heathwood, Francis Howard-Snyder, Hud Hudson, Shawn Larson-Bright, and Ned Markosian. To my knowledge, none of them endorse TOPO. This paper is dedicated to a person to whom I owe a debt that I can never repay, Hud Hudson, and to Robert McDaniel, who taught me the importance of relations.

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