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Composition

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Abstract and Keywords

This article is intended as an introduction to the central questions about composition and a highly selective overview of various answers to those questions. §1 reviews some formal features of parthood that are important for understanding the nature of composition. §2 examines the special composition question: which pluralities of objects together compose something? §§3–4 examines the argument from vagueness for unrestricted composition. §5 addresses questions concerning the uniqueness of composition, coincident objects, hylomorphism, and the so-called grounding problem. §6 concerns the question of which composites exist *fundamentally*.

Keywords: Composition, composites, parthood, objects, argument from vagueness, special composition question, hylomorphism, grounding problem, fundamentality

When some objects are the parts of another object, they *compose* that object, and that object is *composite*. This article is intended as an introduction to the central questions about composition and a highly selective overview of various answers to those questions. In §1, we review some formal features of parthood that are important for understanding the nature of composition. In §2, we consider some answers to the question: which pluralities of objects together compose something? As we will see, the dominant answers are *all of them* and *none of them*. In §§3–4, we examine one of the main arguments that has driven philosophers to these extreme answers: the argument from vagueness. In §5, we turn to the question of whether composition is unique: is it sometimes the case that some things compose more than one thing? Finally, in §6, we turn from the question of which composites exist to the question of which composites exist *fundamentally*.¹

1. Preliminaries

1.1 Mereological Preliminaries

The composition relation is defined in terms of parthood: some things, the *x*s, *compose* something, *y*, iff (i) each of the *x*s is a part of *y*, and (ii) each part of *y* overlaps (i.e., shares a part with) at least one of the *x*s.² So it will be useful to begin with an overview of some common assumptions in the theory of parthood (a.k.a. mereology).

The parthood relation is widely assumed to be a partial ordering, which is to say that it is reflexive, anti-symmetric, and transitive. The assumption that parthood is reflexive—that everything is a part of itself—may seem odd. The table has its legs as parts, but the table intuitively does not have *itself* as a part. If anything, the parthood relation seems to be *irreflexive*. However, this worry can easily be quieted. Those who maintain that parthood is reflexive will readily concede that the familiar relation expressed by such ordinary uses of ‘part’ as ‘the handle is a part of the mug’ is not reflexive. We may call this familiar relation *proper parthood*. The metaphysician’s somewhat artificial, extended use of ‘part’ can then be understood in terms of proper parthood: *x* is a part of *y* (in the intended sense) iff_{def} *x* is a proper part of *y* or *x* = *y*. So defined, since everything is identical to itself, it follows trivially that everything is a part of itself. This artificial use of ‘part’ is a mere convenience and can be eliminated and replaced with more complex formulations that employ ‘part’ in its ordinary sense.³

Since parthood is reflexive, it is not asymmetric. (It is sometimes the case that *x* is a part of *y* and *y* is a part of *x*, namely, whenever *x* = *y*.) But parthood does appear to be anti-symmetric, that is, it is impossible for *distinct* objects *x* and *y* to be such that *x* is a part of *y* and *y* is a part of *x*.⁴ And it is highly plausible that parthood is transitive: every part of a part of an object is also a part of that object.

One may be tempted to deny the transitivity of parthood on the basis of examples like the following. Suppose that, although astronomers have studied the planet Osiris, they have not had the opportunity to study its core. The core is a part of Osiris and Osiris is a part of the assortment of objects studied by astronomers. So, if parthood is transitive, it seems to follow that the core is likewise a part of that assortment:

(A1) Osiris’s core is a part of Osiris.

(A2) Osiris is a part of the assortment of things that have been studied by astronomers.

(A3) If x is a part of y and y is a part of z , then x is a part of z .

(A4) So, Osiris's core is a part of the assortment of things that have been studied by astronomers.

A1 and A2 seem true, and yet A4 is plainly false. So, the idea goes, the culprit must be A3, the principle of transitivity.

Such arguments very plausibly rest on some sort of equivocation, although the exact nature of the equivocation is debatable. There are two basic approaches. The first is to maintain that the argument is sound so long as 'part' is being used in its broadest sense. But, the idea goes, 'part' has various restricted uses as well, and when A4 seems false to us, we are hearing some restricted use of 'part'. For instance, perhaps we are hearing it as saying that the core is a *direct part* of the assortment, where x is a direct part of y iff x is a part of y but not in virtue of being a part of something else.⁵ And indeed A4 is false if we read 'part' as 'direct part'. But then so is A3: direct parthood plainly is not transitive.

The other approach (which we prefer) is to deny that there is any sense of 'part' on which the argument is sound. One way to develop this response proceeds from the idea that 'the assortment of things studied by astronomers' is grammatically singular but referentially plural—it refers not to one thing but to many—and 'part' is naturally read as expressing the *amongness* relation in combination with such terms. Thus, on this approach, 'Osiris is a part of the assortment' means that Osiris is among them—it is one of them—where the *them* in question is Osiris, Saturn, Neptune, and the other things that have been studied by astronomers.⁶ So A2 is true when 'part' is read as expressing amongness but, the idea goes, it is false when read as expressing the ordinary parthood relation that holds between a mug and its handle. Yet if 'part' is read as expressing amongness throughout, A1 is false: the core is not among Osiris. So the argument rests on an equivocation.

The thesis that the assortment is identical to the items currently in the assortment may appear to fall victim to Leibniz's Law arguments like the following. Suppose that astronomers later discover and study a new galaxy. When this happens, the assortment of things that they have studied gets larger. But the things that (as of now) they have studied do not get any larger. So it may appear that, by Leibniz's Law, they are distinct. Appearances, though, are surely deceiving. No one thing truly gets larger when the assortment gets larger, any more than some one thing gets longer when the part of this sentence that you have read gets longer. The truth conditions of 'the assortment got larger' require only that 'the assortment' first refers to some things, later refers to some other things, and that the latter are greater in number than the former.

A similar strategy can be used to address other putative counterexamples to the transitivity of parthood. For instance, Kagan is a part of the Supreme Court, and her arm

is a part of her, but her arm is not a part of the Supreme Court.⁷ ‘The Supreme Court’ refers plurally to the nine justices, and ‘is a part of’ in ‘Kagan is a part of the Supreme Court’ expresses the amongness relation, as it is wont to do in combination with referentially plural terms. There are, to be sure, apparent differences between the Supreme Court and the nine justices. For instance, the former but not the latter will grow if a tenth justice is added to the Court. But these apparent differences, like the apparent differences between the studied objects and the assortment of studied objects, are arguably merely apparent as well.^{8,9}

1.2 Terminological Preliminaries

For the benefit of newcomers to this literature, let us issue a few warnings about varying uses of relevant terminology.

First, ‘fusion’ is sometimes used interchangeably with ‘composite’: something is a fusion iff it has proper parts. Other times it is used to characterize a very specific kind of composite, one that has all of its parts necessarily. So, a table is a fusion in the first sense but (very plausibly) is not a fusion in the second sense. The same goes for ‘sum’.

Second, we have said that the *x*s *compose* *y* just in case (i) each of the *x*s is a part of *y* and (ii) each part of *y* overlaps at least one of the *x*s. But some add a further condition to the definition: (iii) no two of the *x*s overlap.¹⁰ On this more stringent use of ‘composition’, your left hand and left thumb do not count as composing anything because they share parts in common (e.g., a thumbnail), though they can still be said to have a fusion (or a sum).

Third, ‘composition’ and ‘constitution’ are standardly used to refer to different relations. Constitution is commonly construed as a relation that always relates a single object (e.g., a lump of clay) to another single object (e.g., a statue).¹¹ Composition, by contrast, is a relation that can relate a single object (e.g., a statue) to a plurality of objects (e.g., a head, torso, legs, and arms).

Fourth, ‘mereology’ is used to refer to the philosophical study of parthood, or sometimes, more narrowly, to formal approaches to the topic. But it is also sometimes used to refer to a particular theory of parthood—*classical extensional mereology*—which holds (among other things) that composition is unrestricted (see §2) and unique (see §5).¹²

2. The Special Composition Question

The special composition question asks: under what conditions do some things compose something?¹³ A useful answer will give us some insight into *which* composites there are, as well as some idea of what sorts of nonmereological facts are relevant to determining the mereological facts. So we would not be satisfied with a mere reiteration of the definition of composition: some *x*s compose something iff there is something, *y*, such that each of the *x*s is a part of *y*, and each part of *y* overlaps at least one of the *x*s.¹⁴

The two extreme answers to the question fare better in this regard. On one extreme, we have *universalism*, the thesis that pluralities of objects always compose something:

Universalism Some objects compose something iff they exist.¹⁵

Thus, assuming that your nose and the Eiffel Tower both exist, universalism will entail that there is something composed of your nose and the Eiffel Tower, something that is partly fleshy and on your face and partly iron and in Paris.

We say *assuming that these objects exist* because universalism is actually silent on the question of which kinds of objects there are. Whenever there are some things arranged nosewise, universalism will deliver *something* composed of those things. But it remains open to universalists to deny that this composite is a nose. Universalism does not by itself deliver an ontology of ordinary objects.

The other extreme answer is *nihilism*, the thesis that two or more things never together compose anything. Framed as an answer to the special composition question, it often receives the following peculiar formulation:

Nihilism Some objects compose something iff there is exactly one of them.¹⁶

Why “exactly one of them”? Since each object is trivially a part of itself (on the reflexive use of ‘part’), each object trivially composes itself; so, assuming that a single object is “some objects”, each object is some objects that compose something, namely, itself.¹⁷

So what is there according to the nihilist? Nihilists typically accept countless microscopic simples (i.e., partless objects). However, nihilism is also compatible with *existence monism*, the thesis that there is a single, all-encompassing simple (the cosmos).¹⁸ Either way, assuming that ordinary objects like tables, if they exist, are individual composite objects, nihilism will entail that there are no such ordinary objects. We say *assuming* because one may in principle accept a nonstandard nihilist view on which, just as ‘the

assortment' refers plurally to the assorted items (see §1.1), 'the table' refers plurally to the simples that we would ordinarily take to compose the table. In that case, there is a table, but the table is not an individual composite object; it is many objects.¹⁹

Common sense would seem to demand some answer between the two extremes of universalism and nihilism. Surprisingly, though, the extreme answers have dominated the discussion of the special composition question. Why have moderate answers—those between the two extremes—been largely neglected?

There are at least three reasons. The first is that many regard the extreme answers as being entirely compatible with common sense and advance compatibilist accounts of the apparent conflict.²⁰ For example, universalists will concede that, when confronted with a nose and the Eiffel Tower, common sense demands that we assent to 'there is nothing partly fleshy and partly metal'. But universalists often try to accommodate this demand by appeal to quantifier domain restriction: just as someone who looks in the fridge and says 'there is no beer' means only that there is no beer *in the fridge*, one can say 'there is nothing partly fleshy and partly metal' and mean only that there is nothing *belonging to any familiar kind* that is partly fleshy and partly metal.²¹ And universalists will readily admit that nose-tower fusions are not a *familiar* kind of thing.

Nihilists also have compatibilist strategies. For instance, some have suggested that a sentence like 'there are composite objects' means one thing in the mouth of an ordinary speaker and means something different in the mouth of an ontologist. Ordinary utterances of that sentence, the idea goes, express a commonsense truth about what exists₁, while ontological utterances express a distinct (and false) proposition about what exists₂. The idea, then, is that nihilists do not run afoul of common sense in denying that composites exist₂ because, while common sense has clear views about what exists₁, it has nothing to say about what exists₂ (which on this view is something that only ontologists care about).²²

The second reason that moderate answers have been largely neglected is that it has proven extraordinarily difficult to articulate a moderate answer to the special composition question that delivers a commonsense ontology. The only moderate answer that has generated any substantial discussion is van Inwagen's decidedly non-commonsensical organicist answer:

Organicism Some objects compose something iff their activity constitutes a life.²³

This entails that organisms are the only composites, thus (apparently) flying in the face of common sense by excluding all of the inanimate composites.²⁴

Another moderate answer, one which does look to be compatible with common sense, has recently been advanced by Ned Markosian:

Regionalism Some objects, the *x*s, compose something iff there is a region, *r*, and an object, *y*, such that *r* is the fusion of the regions occupied by the *x*s and *y* occupies *r*.²⁵

In other words, some things compose something whenever there's an object in the region they jointly occupy. Regionalism is an immediate consequence of the spatial theory of parthood:

STP *x* is a part of *y* iff the region occupied by *x* is a subregion of the region occupied by *y*.²⁶

But while this answer is compatible with common sense, it doesn't *deliver* a commonsense ontology; it does not even rule out universalism or nihilism. Accordingly, it gives us little insight into which objects there are.²⁷ Moreover, there are apparent counterexamples to both regionalism and STP involving interpenetrating objects. For instance, it seems at least possible for there to be an object that passes through a larger object and that, for a moment, is completely within the boundaries of the larger object. Plausibly, the smaller object needn't be a part of the larger object at that moment. But regionalism entails that it must be: since the smaller object's region occupies a subregion of the larger object's region, it follows that the larger object is partly composed of the smaller one.²⁸

Neither organicism nor regionalism delivers a commonsense ontology. However, Carmichael (2015) develops a moderate answer that does (or at least comes close). The answer centrally depends on a distinction between two kinds of material objects: *event-based* objects such as organisms or hurricanes and *lump-like objects* such as rocks. Roughly, the idea is that, if some things are event-based, then they can compose a further object only by being caught up in a "unity-imposing event" (e.g., a life).²⁹ But, if some things are lump-like, they can compose a further object either by being caught up in such an event or by simply being bonded together. Putting this all together, we get *compositional disjunctivism*, a series-style answer to the special composition question (one that identifies different relations underlying composition for different kinds of compositors):

Disjunctivism Necessarily, for all *x*s, there is a *y* such that the *x*s compose *y* iff either (i) the *x*s are lump-like and the *x*s are bonded, or (ii) the activities of the *x*s constitute an event that imposes sufficient unity on the *x*s.³⁰

The answer arguably does not deliver all of the composites recognized by common sense, in particular, ordinary scattered objects such as supreme courts (more on this below). But it does explain why two people cannot come to compose something by being bonded at the hand, while some bricks can come to compose a wall by being bonded together.³¹

The third reason that the extreme answers have dominated these discussions is that there are powerful arguments that purport to show that any answer that does deliver a commonsense ontology is bound to give rise to objectionable sorts of *arbitrariness* and *vagueness*.

Arbitrariness arguments proceed from the observation that there seem to be no explanatory differences between certain objects that common sense recognizes and those it doesn't. For instance, any account that accords with common sense will need to deliver scattered objects like supreme courts, but no extraordinary object composed of your nose and the Eiffel Tower. Yet there would seem to be no difference between them that could explain why there are things of the one kind but not the other. Thus, the idea goes, any answer that does deliver a commonsense ontology is bound to be intolerably arbitrary and should be rejected for that reason.³²

But these arguments are far from decisive. As we saw in §1.1, 'the Supreme Court' arguably does not refer to a single composite object at all, but rather refers plurally to nine things. In that case, unlike the putative object composed of your nose and the Eiffel Tower, the Supreme Court is not a single object; rather, it is nine objects. This is an explanatory difference because there are plausibly constraints on how some things must be integrated in order to compose a single object, constraints which rule out there being an object composed of your nose and the Eiffel Tower. Since the Supreme Court justices don't compose a single object, such constraints have no bearing on the existence of the Supreme Court.³³

The argument from vagueness has received far more critical attention than the arbitrariness arguments. The next two sections are devoted to examining the argument from vagueness and some possible responses.

3. The Argument from Vagueness

Here is the argument from vagueness:

(B1) If universalism and nihilism are false, then it is possible for there to be a sorites series for composition.

(B2) Any such sorites series must contain either an exact cut-off or borderline cases of composition.

(B3) There cannot be exact cut-offs in such sorites series.

(B4) There cannot be borderline cases of composition.

(B5) So either universalism or nihilism is true.³⁴

B1 is extremely plausible. A sorites series for composition is a series running from a case in which composition does not occur to a case in which it does occur, where adjacent cases in the series are extremely similar in all the respects that are intuitively relevant to whether composition occurs (e.g., spatial and causal relations). As an illustration, consider the assembly of a hammer from a handle and a head, and suppose (as common sense would have it) that they do not compose anything at the beginning of the assembly process and that they do compose something by the end. In that case, the moment by moment series leading from the beginning to the end of the assembly would be a sorites series for composition.

The idea behind B2 is that any such series must contain *some* transition from composition not occurring to composition occurring, and in any given series there either will or will not be an exact point at which that transition occurs.³⁵

B3 is plausible. If there is an exact cut-off in such a series, then surely there must be some explanation for why the cut-off is where it is; compositional facts are not brute.³⁶ Yet the sorts of differences that one finds among adjacent cases in a sorites series for composition—for instance, that the handle and head are a fraction of a nanometer closer together in the one than in the other—can't plausibly explain why the cut-off occurs just there.

The argument against borderline cases of composition turns on the observation that if there were such borderline cases, then some *numerical sentence* would evidently have to lack a determinate truth value. A numerical sentence is a sentence of the following sort which says, for some number n , that there are exactly n concrete objects (in this case, $n = 2$): $\exists x \exists y (x \neq y \ \& \ Cx \ \& \ Cy \ \& \ \forall z (Cz \rightarrow (x=z \vee y=z)))$.³⁷ Here, then, is the argument for B4:

(B6) If there could be borderline cases of composition, then it is possible for some numerical sentence to lack a determinate truth value.

(B7) If it is possible for some numerical sentence to lack a determinate truth value, then some expression in some numerical sentence must be vague.

(B8) No expression in any numerical sentence is vague.

(B4) So, there cannot be borderline cases of composition.³⁸

Here is the idea behind B6. Suppose (for ease of exposition) that the only objects that exist are a hammer handle, a hammer head, and that (if anything) which they compose. And suppose that it is indeterminate whether the handle and head compose something. In such a case, it would seem to be indeterminate how many objects there are: just the handle and head, or the handle, the head, and a further object composed of the two. Thus, the numerical sentence for two (above) would be neither determinately true nor determinately false.

The idea behind B7 is that, since the source of the indeterminacy would presumably be vagueness—as opposed to, say, reference failure or the open future—there must be some vague expression in the sentence that is responsible for the vagueness.

The defense of B8 turns on the assumption that an expression is vague only if there is a range of candidate precise meanings for the term (“precisifications”), none of which definitely has been selected as the meaning of the term and none of which definitely hasn’t. This is a central plank of the orthodox linguistic account of vagueness, according to which vagueness is always the result of our semantic indecision. Arguably, though, none of the expressions in the numerical sentence has multiple candidate precisifications. Take ‘*V*’. ‘*V*’ has multiple precisifications only if it has multiple candidate domains at some world at some time. In order for the domains to differ at all, there must be something that is in one but not the other. Yet whichever precisification of ‘*V*’ is associated with a domain that leaves something out cannot be an *admissible* precisification of ‘*V*’, since any candidate for being a precisification of ‘*V*’ in a numerical sentence would have to range over absolutely everything. So ‘*V*’ cannot have multiple precisifications.³⁹

The usual strategies for resisting the argument involve denying B3 or B8. One can deny B3 by affirming that there can be exact cut-offs in such sorites series, and either supplying an explanation for the location of the cut-off or denying that any such explanation is needed.⁴⁰ Or one can deny B8 by either supplying candidate precisifications or denying that vagueness requires multiple precisifications.⁴¹ But there have also been a number of recent attempts to block the argument at B6, by denying that borderline composition ever gives rise to indeterminacy in how many objects exist. Let us turn now to some of those attempts.

4. Borderline Composition without Vague Existence

B6 says that if there can be borderline cases of composition, then there can be count indeterminacy—indeterminacy with respect to how many concrete objects there are. The premise does not require that *all* cases of borderline composition give rise to count indeterminacy, and rightly so, since some putative cases of borderline composition plainly would not result in count indeterminacy. Suppose, for instance, that there are exactly one billion things, the As, that are definite proper parts of Tibbles the cat and exactly one object, B, that is a borderline part of Tibbles. It is therefore indeterminate whether the As together with B compose Tibbles; and if they do not compose Tibbles then (*pace* universalists) they plausibly do not compose anything at all. So the As together with B are a borderline case of composing something. But this is not a case of count indeterminacy. There are exactly a billion and two concrete objects in this case: Tibbles, B, and the billion As.

The reason that borderline composition does not give rise to count indeterminacy in the Tibbles case is that there is a *DEO*: a definitely existing object that the borderline composers are a borderline case of composing. By contrast, the hammer case does not seem to involve any *DEO*. There does not seem to be any definitely existing object that the handle and head are a borderline case of composing, which is why, in contrast to the Tibbles case, it would seem to be indeterminate whether there is something in addition to the borderline composers. So, unlike the Tibbles case, the hammer case does seem to give rise to existential indeterminacy and thus threatens to give rise to count indeterminacy.

Suppose, though, that one insists that there are *DEOs* in every case of borderline composition, even in the hammer case. Then one would deny B6: borderline composition never gives rise to count indeterminacy. We will examine a handful of such *DEO* maneuvers.

4.1 Eternalism

Eternalists maintain that past and future objects exist; not everything that exists is present.⁴² They may say that there exists a *DEO*—namely, a future hammer—which the handle and head are (at present) a borderline case of composing. In that case, there are exactly three concrete objects: the handle, the head, and the hammer, which does not

definitely exist at present but does definitely exist *simpliciter*. Thus, there is no count indeterminacy.

The problem with this strategy is that it cannot accommodate cases of aborted assembly. Suppose that I am affixing the handle to the head, but I abort the assembly process at some point in the grey area, that is, at one of the points at which it seems indeterminate whether the handle and head compose anything. In that case, there will be no definitely existing future hammer to serve as the DEO. So we would seem to have a borderline case of composition in which it is indeterminate whether there is anything (past, present, or future) in addition to the handle and head that they are a borderline case of composing. And that is enough to make B6 true.⁴³

What's needed is an account that supplies a DEO even in aborted assembly cases. The following accounts do just that.

4.2 Necessitism

Necessitism is the thesis that necessarily everything necessarily exists.⁴⁴ So we exist necessarily, as do you. This is not to say that we are necessarily people, or even that we are necessarily concrete objects, but just that we necessarily exist (as something or other). Necessitists are also committed to the existence of merely possible people. For instance, it is possible for Wittgenstein to have had a daughter, so, by necessitist lights, there exists something which could have been his daughter. Given plausible Kripkean assumptions about origins, since in fact he had no daughter, no actual woman could have been his daughter. Nor could any other concrete or located object have been his daughter. So any entity that could have been his daughter must then be some nonconcrete, nonlocated object.

These contingently concrete necessary existents are well suited to play the role of DEO, even in aborted assembly cases. Even if the assembly is never completed—indeed, even if the assembly is never begun—there definitely exists an object (a DEO) that the handle and head *would* compose were the assembly carried to completion.⁴⁵ In the grey area, the handle and head are a borderline case of composing that object. Thus, even in the grey area, it is fully determinate which objects exist and how many objects exist.⁴⁶

Necessitism, however, is a hard pill to swallow. Necessitists have to deny such apparent truisms as *it is contingent whether you exist* and *had your parents never met you would never have existed*. Moreover, necessitism runs afoul of plausible essentialist theses. Very plausibly, the things which are actually tigers are necessarily tigers, in which case they are tigers in every world in which they exist. But, by necessitist lights, there are

worlds in which they are not even physical or concrete, much less tigers. So necessitists are committed to denying that tigers are necessarily tigers.

What necessitists *can* say is that tigers are necessarily *tigers if concrete*, that is, they are tigers in every world in which they are concrete.⁴⁷ However, it is unclear how this is supposed to mitigate the implausibility of necessitism's anti-essentialist consequences. To see this, consider the equally plausible claim that tigers are necessarily concrete. The present rephrasal strategy would render this as *tigers are necessarily concrete if concrete*. But surely that's not what we have in mind when 'tigers are necessarily concrete' strikes us as plausible. Worse, the intuitively true claim 'unlike numbers, tigers are necessarily concrete' gets rephrased as the falsehood *unlike numbers, tigers are necessarily concrete if concrete*—false, because numbers are (vacuously) concrete if concrete in all worlds.

4.3 Supersubstantialism

Supersubstantialism is the thesis that each material object is identical to the region of space that it occupies. To see how supersubstantialists can resist B6, consider the following two theses. The first is the analogue of universalism for regions:

UR If the *rs* are some regions, there exists a region *R* such that (i) each of the *rs* is a subregion of *R* and (ii) every subregion of *R* shares a subregion with at least one of the *rs*.

The second is that regions are always parts of the regions whose subregions they are:

RP If *r* is a subregion of *R*, then *r* is part of *R*.

Suppose that supersubstantialists accept UR but reject RP, placing some constraints on when some regions count as parts of the regions whose subregions they are (perhaps mirroring our intuitive constraints on when some objects are parts of something). In that case, they are well positioned to reject B6. By UR, there will be a region of space that the handle and head jointly occupy irrespective of whether they compose anything. Thus, even in borderline cases of composition, there is no indeterminacy in what exists: the handle, the head, and the region jointly occupied by the two. All that is indeterminate is whether they count as standing in the composition relation to the region whose subregions they are. B6 is false.⁴⁸

Like necessitism, many will find supersubstantialism unpalatable. For one thing, it flies in the face of common sense: your head occupies a region of space but is not itself a region of space. Furthermore, objects and their locations differ in obvious ways. Your

head could have been somewhere else. But the region it occupies could not have been anywhere else. So, by Leibniz's Law, your head is not identical to its location.⁴⁹ For these reasons, it would be preferable if we could execute a similar strategy for blocking B6—one that invokes located and contingently existing DEOs—without relying on the extremely controversial identification of objects with regions. The following proposal promises to do just that.

4.4 Expansions

Let us say that y is an *expansion* of the x s just in case y exactly occupies the region that is jointly occupied by the x s.⁵⁰ One might naturally think that some objects have an expansion iff they compose something. Indeed, this follows straightaway from the right-to-left direction of the aforementioned spatial theory of parthood:

STP_{RTL} If the region occupied by x is a subregion of the region occupied by y , then x is a part of y .

Given STP_{RTL}, if the handle and head have an expansion in the grey area, then they definitely do compose something in the grey area.

But suppose one were to deny STP_{RTL} (perhaps because of the problem involving interpenetrating objects mentioned in §2). Suppose, in particular, that although it is indeterminate whether the handle and head compose something in the grey area, there definitely exists an expansion of the handle and head at every point in the grey area. This would be an object which is exactly located in the region jointly occupied by the handle and head, but which does not now definitely have them as parts. Accordingly, this borderline case of composition does not give rise to count indeterminacy, since it is perfectly determinate which things exist in the grey area: the handle, the head, and the definitely existing expansion (our DEO) which they are a borderline case of composing. B6 is false.⁵¹

But if objects don't have to compose something in order to have an expansion, what *does* it take for some objects to have one? A natural answer for proponents of the envisaged DEO maneuver is to say that some objects have an expansion iff it isn't definitely the case that they do not compose anything.⁵² That is, there's an expansion whenever some things definitely compose something, and whenever it's indeterminate whether they do, but not when they definitely don't.

One serious problem with this answer has to do with higher-order vagueness. For just as there seems to be no sharp point at which the handle and head transition from definitely

composing nothing to definitely composing something, there seems to be no sharp point at which they transition from definitely composing nothing to its being indeterminate whether they compose something. And supposing that it is indeterminate where this transition occurs, there will be times at which it is indeterminate how many things exist: just the handle and head, or the handle, the head, and their expansion. But this is just to concede that B6 is true: borderline cases of composition do sometimes give rise to count indeterminacy.

The problem can be avoided. Following Williamson, we can define a super-definitely operator (D^*) in terms of the definitely operator (D) as follows:

$$D^*p \text{ iff}_{\text{def}} Dp \ \& \ DDp \ \& \ DDDp \ \& \ \dots$$

It can be shown that if something is super-definitely true, then it is *definitely* super-definitely true: $D^*p \rightarrow DD^*p$.⁵³ Thus, while there can be vagueness with respect to what's definitely the case, there can be no indeterminacy with respect to super-definiteness and, in particular, no indeterminacy with respect to whether some things super-definitely compose something.⁵⁴ Accordingly, we can escape the worry about higher-order indeterminacy by revising the above answer to say that some things have an expansion iff it is not *super-definitely* the case that they do not compose anything.

This modified answer has some consequences that some may find unpalatable. For consider again the case in which the As are all definitely parts of Tibbles and B is a borderline part. Since the As don't super-definitely fail to compose something, the modified answer entails that they have an expansion, exactly located where they are. Likewise, the As together with B don't super-definitely fail to compose something, in which case they too have an expansion, exactly located in the slightly larger region where they are. But those who oppose the argument from vagueness on the grounds that universalism violates common sense may wish to avoid this implication that there is a multitude of cat-like objects in the vicinity of Tibbles.⁵⁵

An alternative that would avoid this multitude is a picture on which there is a single definitely existing cat-like expansion in Tibbles's vicinity, but it is not determinate *which* candidate parts this expansion is an expansion of.⁵⁶ Thus, it is not determinate where exactly this expansion is located. Here is one way to develop this sort of picture. First, we say that the xs *generate* a DEO just in case they do not super-definitely fail to compose something. But we allow that different pluralities of objects can generate the same DEO. Specifically, the xs and the ys generate the same DEO just in case the xs generate a DEO, the ys generate a DEO, and each of the xs is either one of the ys or in the penumbra of the ys, and each of the ys is either one of the xs or in the penumbra of the xs. (An object x is in the penumbra of the ys just in case x is not one of the ys and it is not super-definitely

true that x and the y s fail to compose something.) Finally, we say that the x s have an expansion just in case (i) the x s generate a DEO, and (ii) there are no y s ($\neq x$ s) which compose something, and which are such that the x s and the y s generate the same DEO. Thus, in the Tibbles case, it is indeterminate whether the A s have an expansion, since it is indeterminate whether the A s and B compose something, and so indeterminate whether condition (ii) is satisfied.

The expansionist strategy provides a DEO in cases of aborted assembly, it allows material objects to be contingently existing and necessarily concrete, and it avoids the implausible identification of objects with their locations. For these reasons, we regard the expansionist strategy (in some form or other) as the most plausible DEO maneuver for resisting the argument from vagueness.

5. Uniqueness

We have been considering the question of whether some things ever (or always) compose something. Let us turn now to the question of whether some things ever compose more than one thing. It is at least *prima facie* plausible that this never happens: objects compose at most one object at any given time. Call this *Uniqueness*:

Uniqueness If x and y have the same proper parts, then $x = y$.

And yet there appear to be counterexamples.

5.1 Leibniz's Law and Colocated Objects

Athena is a clay statue, and Piece is the piece of clay of which it is made.⁵⁷ Athena and Piece seem to have exactly the same proper parts. But they evidently differ in other respects: Piece but not Athena is able to survive being flattened. So, by Leibniz's Law, they must be distinct. Call this *Distinctness*:

Distinctness Athena \neq Piece.

Let us call the thesis that objects are typically (if not always) distinct from the pieces of matter that share their location *colocationism*.

Suppose that this argument is sound and that colocationism is correct.⁵⁸ Must we then suppose that Athena and Piece are a counterexample to Uniqueness? Perhaps not. We will examine three strategies for reconciling Uniqueness and colocationism: denying that

Athena and Piece have the same ordinary spatial parts, denying that they have the same temporal parts, and denying that they have the same formal parts.

First, colocationists will likely maintain that Athena's *arm* is a part of Athena but not a part of Piece.⁵⁹ After all, when the statue is squashed, its arm is destroyed but no part of the piece of clay is destroyed. But one need not look far to find new counterexamples to Uniqueness. Take Athena's thumbnail, Nail, and the piece of clay that constitutes it, Piece_N. Piece_N but not Nail can survive being rolled into a ball, which, by Leibniz's Law, entails that Nail \neq Piece_N. But whereas there are ordinary spatial parts of Athena that intuitively are not parts of Piece, there do not appear to be any ordinary spatial parts of Nail that are not parts of Piece_N. So this strategy cannot handle all apparent counterexamples to Uniqueness.⁶⁰

Second, one might maintain that Athena and Piece have different *temporal* parts. Here the idea is that Athena and Piece are each four-dimensional objects, composed of instantaneous three-dimensional "slices" or "stages". Suppose that Piece existed on Monday and was not made into a statue until Tuesday. In that case, Athena and Piece share some of their temporal parts—for instance, the three-dimensional statue-shaped slices that are around on Tuesday—but only Piece has as parts Monday's three-dimensional lump-shaped slices. So this is no counterexample to Uniqueness. Again, though, this strategy cannot handle all apparent counterexamples. For suppose that Athena and Piece come into existence simultaneously and cease to exist simultaneously.⁶¹ Suppose, for instance, that the materials used to create Piece were mixed in the very mold used to make Athena, so that when they hardened they were already in the shape of a statue, and that both were later simultaneously annihilated. In that case, even supposing that they have temporal parts, they will have precisely the same temporal parts.⁶²

The third, *hylomorphic* strategy relies on the idea that Piece and Athena, despite being made of the same matter, have different *forms*. There are different conceptions of what sorts of things forms might be: universals, tropes, powers, events, sortals, structures, etc. For purposes of illustration, let us suppose that forms are shapes: *being Athena-shaped* is Athena's form and *being Piece-shaped* is Piece's form. The property of being Athena-shaped is a determinable of which the specific shapes that Athena is capable of taking on are determinates. Similarly, the property of being Piece-shaped is a determinable of which the (wider range) of specific shapes that Piece can take on are determinates.⁶³ The idea, then, is that, while both Athena and Piece *instantiate* both shapes, only Athena has Athena-shapedness *as its form* and only Piece has Piece-shapedness *as its form*.

But if an object's instantiating a form does not suffice for the object to have it *as* its form, what more is required? One possible answer is that the object must additionally have the form as a part. According to *mereological* hylomorphism, the form of an object is literally a part of the object; an object's parts are not limited to material objects.⁶⁴ Athena's form is a part of Athena but not Piece, and Piece's form is a part of Piece but not Athena. Thus, there is no counterexample to Uniqueness; they do not share all of their parts.

Mereological hylomorphism also easily handles cases of permanent colocation, for even permanently colocated objects can differ in form. And it easily handles the case of Nail and Piece_N, which themselves differ in form. Finally, it offers a distinctive solution to the most serious objection to colocationism: the grounding problem.

5.2 Mereological Hylomorphism and the Grounding Problem

The grounding problem for colocationism is that the putative modal and sortal differences between colocated objects like Athena and Piece seem to stand in need of explanation, and yet there seems to be no further difference between them that is poised to explain their modal and sortal differences.⁶⁵ Here, then, is the hylomorphic solution to the grounding problem. Athena and Piece have different modal and sortal properties because they have different forms. Piece is possibly flat because it has *being Piece-shaped* as its form; Athena isn't possibly flat because it has *being Athena-shaped* as its form. Athena, unlike Piece, is a statue because, unlike Piece, it has *being Athena-shaped* as its form.

For the mereological hylomorphist, Athena but not Piece has *being Athena-shaped* as its form because Athena but not Piece has it as a part. But one might object that this simply gives rise to a new grounding problem, for now the hylomorphist owes us some explanation of the mereological difference between Athena and Piece.⁶⁶ Both instantiate Piece-shapedness, and both instantiate Athena-shapedness, so what could explain why Athena-shapedness is a part of the one but not the other, while Piece-shapedness is a part of the other but not the one?

Hylomorphists ought to respond that there is *no* explanation of why Athena-shapedness is a part of Athena and not a part of Piece. This mereological difference is explanatory bedrock. And there is special reason to suppose that mereological differences are sometimes explanatory bedrock. To see this consider "Lefty", the left one-third of a certain brick. In virtue of what is Lefty a part of the brick but not a part of the right two-thirds of the brick? There is no plausible answer; it just is a part of the one but not the other.⁶⁷ Or consider the four-dimensionalist account described above, according to which Piece has temporal parts that Athena lacks. Here is a question that one would not think to put to a four-dimensionalist: in virtue of what are they parts of Piece rather than parts of

Athena?⁶⁸ Nor have four-dimensionalists been concerned to answer that question. That's because the question does not seem to require an answer. These kinds of mereological differences are explanatory bedrock.

One might object that these mereological facts are explained in terms of the locations of the various objects: Lefty is a part of the brick because Lefty is located in a subregion of the brick's location. More precisely:

Lefty is a part of the brick because Lefty is in R_L and **the brick is in R_B** and R_L is a subregion of R_B .

But plausibly the explanation goes in the opposite direction: composites are located where they are because they have parts in those locations.⁶⁹ In particular, the brick is in R_B because it has parts in the subregions of R_B . And the brick has parts in the subregions of R_B partly because Lefty is a part of the brick and is in a subregion of R_B . By transitivity of explanation:

The brick is in R_B partly because **Lefty is part of the brick**.

So, on pain of circularity, it cannot be that Lefty is part of the brick partly because the brick is in R_B . (*Mutatis mutandis* for Athena and Piece.)

Moreover, if parthood is to be explained in terms of location, then it's plausible that STP_{RTL} would have to be true. That is, it's plausible that being in a subregion of an object's location would have to suffice for being a part of that object.⁷⁰ But we have already seen good reasons for being dissatisfied with STP_{RTL} . For instance, it seems perfectly possible for one object to pass through another, and thus to be in a subregion of its location, without thereby becoming a part of it. If STP_{RTL} is true, this cannot happen. Moreover, if STP_{RTL} is true, then Athena's arm is not only a part of Athena, but also a part of Piece, which is rather implausible, at least by colocationist lights. And, in any case, mereological hylomorphists are already committed to denying STP_{RTL} . Since Athena occupies a subregion of Piece's location, STP_{RTL} entails that Athena is a part of Piece. And, since Athena's form is a part of Athena, it would follow (by transitivity) that Athena's form is a part of Piece as well, contrary to hylomorphism.

Mereological facts are plausibly both explanatory and explanatory bedrock. Thus, hylomorphists do seem to be well positioned to solve the grounding problem.

6. Fundamentality

In §2, we considered the question of whether any composite objects exist. We turn now to the question of whether any composite objects exist *fundamentally*. And while the nihilist view that there are no composite objects seems deeply implausible, there is something downright attractive about the view that *at bottom* there are no composite objects, or that fundamentally speaking there are only the atomic parts, or that composites have no role to play in a fundamental description of reality.

We will consider two ways of trying to capture this thought. On the first, the idea is that no composites are themselves fundamental objects. On the second, the idea is that some quantifiers are more fundamental than others and that the most fundamental quantifiers have no composite objects in their domains.

6.1 Fundamental Objects

Some things exist in virtue of others. For instance, there are cracks and holes, and these exist in virtue of there being cracked and perforated objects. Put another way, cracks and holes are less fundamental than their hosts. The same can be said of composites and their proper parts. A wooden ship exists in virtue of its planks existing and being arranged shipwise. The planks, in turn, exist in virtue of the (more fundamental) cellulose molecules that compose them. And so on.

The idea that composite objects exist in virtue of their parts, or are less fundamental than their parts, can be captured by the *parthood priority thesis*:

PPT For any objects x and y , if x is a proper part of y , then x is more fundamental than y .

What, then, is absolutely fundamental? On pain of explanatory regress, there must be *some* fundamental level of objects, in which case PPT entails that the absolutely fundamental objects are mereological simples.⁷¹ (For if any composite object were fundamental, then its parts could not be more fundamental than it, and PPT would be false.) Call this *priority atomism*:

Priority Atomism Some objects are fundamental, and every fundamental object is simple.⁷²

The idea, then, is that every object is either simple or exists in virtue of the simples of which it is composed.

The problem is that it is at least conceivable that there are no simples. Perhaps every object decomposes into proper parts, ad infinitum. Call this *the gunk thesis*:

GT Every object has proper parts.⁷³

If GT is correct, then priority atomism is false: no objects are simple, so either there are no fundamental objects or some composites are fundamental. Indeed, it is problem enough for the priority atomist if gunk is so much as possible. For PPT—the primary motivation behind priority atomism—is presumably necessary if true. Whether composites exist in virtue of their parts or vice versa does not seem like the sort of thing that can vary from one world to the next.⁷⁴

One option, then, is to abandon priority atomism and PPT in favor of some other conception of the fundamental level of objects. For instance, *priority monism*:

Priority Monism There is exactly one fundamental object, the universe, and every object is a part of it.

Priority monists can accommodate the possibility of GT: even if there is an infinite descent of parts in some world, there will still always be a foundation for them, namely, the universe itself. But priority monism faces similar problems. For, arguably, if gunk is possible, then it is also possible for there to be infinite *ascent* of composites, each a proper part of some further composite. Call this the *junk thesis*:

JT For any object x , there is some object y such that x is a proper part of y .

If JT is true, then there is no object that every object is a part of, and priority monism is false. And if JT is possibly true, then priority monism is possibly false. But priority monism (like priority atomism) is presumably necessary if true.⁷⁵

The alternative is to deny GT and indeed to deny that GT is even possibly true.⁷⁶ What does seem obviously possible is that there be certain kinds of infinite descent. But infinite descent need not be endless: just as a Euclidean line can be divided infinitely into smaller and smaller line segments despite being ultimately composed of points, perhaps every composite object can be divided infinitely into smaller and smaller composite parts despite being ultimately composed of simples.

Furthermore, infinite descent need not be mereological. For instance, it does seem possible for there to be objects which can be divided into two halves, and whose halves can in turn be divided into two halves, and so on. But it is controversial whether the fact that an object o can be divided into two halves, h_1 and h_2 , entails that o is not simple. There are at least two ways of resisting the entailment. The first is to deny that h_1 and h_2

exist at all before the division: they are brought into existence when *o* is divided and, a fortiori, are not parts of *o* prior to division.⁷⁷ The second is to concede that, prior to division, *h*₁ and *h*₂ exist and are partially colocated with *o*, but to deny that they are parts of *o*.⁷⁸ This requires denying our old friend STP_{RTL}:

STP_{RTL} If the region occupied by *x* is a subregion of the region occupied by *y*, then *x* is a part of *y*.

But as we have already seen, STP_{RTL} is implausible. One object can pass through another, and be partially colocated with it, without thereby being a part of it.

Thus, one must be careful to distinguish mereological descent from other sorts of descent, not only when consulting intuitions about the possibility of GT, but also in evaluating alleged empirical support for the truth of GT.⁷⁹

6.2 Fundamental Quantification

We have thus far been considering the question of which objects are fundamental, and in particular whether any composites are fundamental. We turn now to the related, but importantly different question of whether the most fundamental quantifiers range over composites. (Or, as it is sometimes put: whether composites exist in the most fundamental sense of ‘exists’.) The question arises in part in connection with the compatibilist strategy touched upon in §2. Some philosophers who wish to affirm ‘there are no objects with parts’ also wish to deny that what they are saying is at odds with the truism expressed by an ordinary utterance of ‘there are some objects with parts’. One way to make good on this compatibilist hypothesis is to suppose that ‘there is’ means different things in ontological and ordinary discussions; in the former, but not the latter, it is a fundamental or “highly natural” quantifier, one that “carves reality at its joints”.⁸⁰

How are we to make sense of this notion of a fundamental quantifier that carves reality at its joints? Proponents of this idea say that the world has structure, and that some descriptions of the world are not only true but also superior to other true descriptions, insofar as they describe the world in a way that more “perspicuously” discloses (or matches or corresponds to) that structure.⁸¹ Let *Ontologese* be the unique language—assuming there is one—that is best equipped for so describing the world. Let the *existential_O quantifier* be the unique quantifier in *Ontologese*—assuming there is one—which is inferentially \exists -like, that is, which plays the same core inferential role as the ordinary existential quantifier.⁸² And let us say that *x exists_O* just in case *x* is in the domain of the *existential_O quantifier*.⁸³

The aforementioned philosophers who would deny that composites exist_O but not that they exist aren't nihilists; nihilists deny that composites exist. Let's call them *deep nihilists*. The question with which we began—whether the most fundamental quantifier ranges over composites—can then be rephrased as the question of whether deep nihilism is true.

What reason might we have for accepting deep nihilism? One might think that deep nihilism falls right out of priority atomism. If simples are the only fundamental objects, they must be the only objects in the domain of the fundamental quantifier.

But the inference from the claim that no composites are fundamental to the conclusion that the fundamental quantifier does not range over composites—or (equivalently) that the most fundamental mode of being is not enjoyed by composites—rests on an assumption that we see no good reason to accept, namely, that the relative fundamentality of a quantifier is measured by the relative fundamentality of the items in its domain. By way of comparison, one wouldn't typically say that a relation can only be as fundamental as its least fundamental relata. Few would deny that identity is fundamental simply because entities of all kinds—fundamental and nonfundamental—stand in the identity relation. Nor is it especially plausible that a restricted identity relation which relates only fundamental objects to themselves is more fundamental than identity simpliciter.⁸⁴ Nor does the fact that conjunction operates on nonfundamental propositions preclude it from being fundamental.

By parity, it is hardly obvious that the most fundamental mode of being cannot be one that is enjoyed by nonfundamental objects, or that the most fundamental quantifiers cannot range over nonfundamental objects. In other words, it is very much an open question whether the only things that exist_O are the things mentioned in the simplest complete Ontologese description of the world. For it may be that some existents_O are nonfundamental objects that have no business being mentioned in such a description, on pain of introducing redundancies and diminishing perspicuity.⁸⁵

Once we clearly distinguish the question of which objects are fundamental from the question of which mode of being is fundamental, other *prima facie* reasons for accepting deep nihilism lose their force as well. For instance, one might allege that composites do not exist_O on grounds of ontological parsimony: an ontology that has only simples at the fundamental level is more parsimonious than one that treats both simples and composites as fundamental.⁸⁶ But, while ontological parsimony is plausibly an advantage, it is not a *distinctive* advantage of deep nihilism. For one can wholeheartedly agree that no composites are fundamental, all the while maintaining that they enjoy the most fundamental mode of being. Put another way: there is no need to suppose that the most

fundamental quantifier “drags” its whole domain down into the fundamental level with it.⁸⁷

Similar points apply to the suggestion that deep nihilism has greater *ideological* parsimony than its rivals. For instance, one might observe that deep nihilists do not need any mereological predicates in their fundamental ideology, since they have no composite objects at the fundamental level.⁸⁸ But *deep universalists*—according to whom all of the universalist’s arbitrary fusions exist_O—can agree that no composites are fundamental and, thus, will be just as well positioned as deep nihilists to eliminate mereological vocabulary from their fundamental ideology. For instance, deep universalists can maintain that the mere fact that fundamental objects $f_1 \dots f_n$ exist_O suffices to explain the (nonfundamental) fact that there exists_O an object composed of $f_1 \dots f_n$. Just as one can think that nonfundamental objects are more familiar than fundamental objects without thinking that the *more familiar than* relation must be referenced in one’s fundamental description of the world, one can think that some nonfundamental objects are composed of fundamental objects without thinking that the *composition* relation must be referenced in one’s fundamental description of the world. It is priority atomism, not deep nihilism, that secures the ideological parsimony.

Thus, although there is an interesting question of which objects are in the domain of the most fundamental quantifier—distinct from the question of which objects are fundamental—it is far from clear what the answer is, and whether there is any good reason to accept deep nihilism about what exists_O.

One final observation about nihilism, deep nihilism, and priority atomism. Given the *prima facie* implausibility of nihilism—that there are no objects with parts—one may be tempted by the thought that what nihilists meant to be saying or ought to have been saying all along is that priority atomism is true or that deep nihilism is true. But this would be a mistake.⁸⁹ Its problems notwithstanding, nihilism has advantages that are altogether lost if one is only willing to say that statues are not fundamental or that statues do not exist_O. The main reason to accept nihilism is that, by eliminating ordinary composites, one thereby escapes a number of problems and puzzles. Denying that statues and other familiar composites exist enables one to secure Uniqueness (see §5) without having to embrace colocationism (temporal parts, etc.), block the argument from vagueness without incurring commitment to vague existence (supersubstantialism, etc.), and escape a variety of other problems involving overdetermination, overpopulation, arbitrariness, fission, and indeterminacy.⁹⁰ These problems all arise simply from the assumption that ordinary composites *exist*, and this is why nihilists, who deny that there are any composites, have a uniform solution to the problems. Those who are willing to say

only that composites aren't fundamental or that they don't exist_O are left with the problems and must find some other response to them.⁹¹

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Notes:

⁽¹⁾ One notable omission is the question of whether composition is identity, that is, whether a composite object is identical to its parts. See Baxter (1988a, 1988b), Lewis (1991: §3.6), van Inwagen (1994), Yi (1999), Sider (2007: §3), Wallace (2011a, 2011b), and Baxter and Cotnoir (2014) for discussion. See Harte (2002: 114), Merricks (2005: 629–631), Sider (2007: 61–62), McDaniel (2010b), and Cameron (2012) on whether the composition as identity thesis entails the universalist thesis discussed in §2.

(²) Alternatively, one might define parthood in terms of composition: x is a part of y iff x is among some objects that compose y . See van Inwagen (1987: 24–25) on the interdefinability of parthood and composition. One reason to prefer the definition in the text is that *if the x s compose y , then each part of y overlaps one of the x s* is arguably true by definition, and this fails to come out true by definition on the alternative proposal.

(³) For instance, condition (ii) in the definition of composition would have to be replaced with: each part of y either shares a part with one of the x s *or is identical to one of the x s*.

(⁴) There are, however, some putative counterexamples, involving (among other things) time travel, propositions, and the Trinity. See Cotnoir and Bacon (2012: §1) for discussion.

(⁵) Cf. Casati and Varzi (1999: 34).

(⁶) We should perhaps go further, insisting that A2 as stated is false and only false: Osiris is part of the assortment but is not *a* part of the assortment. Cf. Sharvy (1983: 235) and Simons (1987: 234–235). We ignore this complication here.

(⁷) Cf. Uzquiano (2004b: 136–137).

(⁸) See Uzquiano (2004b: §§4–5) for Leibniz’s Law arguments against the identification of the Supreme Court and the justices; cf. Ritchie (2013: §2). See Korman (2015b: §8.3.2) for criticism.

(⁹) For further discussion of putative counterexamples to transitivity, see Rescher (1955: 10), Cruse (1979), Sharvy (1983: 236), Simons (1987: 107–108), Winston, et al. (1987: §§5–6), Iris, et al. (1988: 277–280), Sanford (1993: 220–222), Moltmann (1998: §1.5), Hossack (2000: 423), Johnston (2002: 142–143), Rosen and Dorr (2002: 153), Schmitt (2003: 5–6), Brogaard (2004: 226), Johansson (2004), Varzi (2006), Effingham (2010: 255), and Korman (2015b: §8.3.3).

(¹⁰) See van Inwagen (1990: 29).

(¹¹) See, e.g., Bennett (2009: 45). Markosian (2004: §2, 2015: §1) and Kleinschmidt (2007), who hold that the *lump* of clay is an object while the clay itself is merely some stuff (and is not an object), reserve ‘constitution’ for a relation between some stuff and a single object.

(¹²) See Leśniewski (1916) and Leonard and Goodman (1940) for early articulations of classical extensional mereology.

⁽¹³⁾ See van Inwagen (1990: ch. 2); see Hestevold (1981) for a precursor. Strictly speaking, the question posed by van Inwagen would be stated in our vocabulary as: under what conditions do some *non-overlapping* things compose something? Like van Inwagen (1990: 20), we restrict our discussion to material objects, except where otherwise indicated. For some discussion of questions of composition that arise for other sorts of entities, see Simons (1987: ch. 4), Chant (2006), King (2007), McDaniel (2009), Tillman and Fowler (2012), and Gilmore (2014).

⁽¹⁴⁾ Cf. van Inwagen (1990: 31), Markosian (1998a: 212–213), and Higgins et al. (ms) on the constraints on a satisfactory answer.

⁽¹⁵⁾ On the more stringent definition of composition alluded to at the end of §1.2, universalism must be characterized as the view that the *x*s compose something iff the *x*s are disjoint (i.e., don't share any parts in common). Proponents of universalism include Leśniewski (1916), McTaggart (1921/1968: 140–141), Leonard and Goodman (1940), Goodman and Quine (1947), Cartwright (1975), Quine (1981: 10), Thomson (1983: 216–217), Lewis (1986: 212–213, 1991: §1.3), Van Cleve (1986, 2008), Heller (1990: §2.9), Armstrong (1997: 13), Sider (1997: §3.1, 2001: §4.9), Rea (1998), Fine (1999: 73), Hudson (2000, 2001: §3.8), Varzi (2003), Bigelow and Pargetter (2006), Braddon-Mitchell and Miller (2006), Baker (2007: 191–193), Schaffer (2009a: 358 n. 11), and Sattig (2015: 13–14).

⁽¹⁶⁾ See van Inwagen (1990: 73).

⁽¹⁷⁾ We ourselves are not so sure that an object is some objects. Cf. Boolos (1984: 443): “Suppose that there is exactly one Cheerio in the bowl before me. Is it true to say that there are some Cheerios in the bowl? My view is no, not really, I guess not, but say what you like, it doesn't matter very much.”

⁽¹⁸⁾ Hossack (2000) and Dorr (2005) defend the microphysicalist version of nihilism. Horgan and Potrč (2000, 2008: ch. 7) and Rea (2001) defend existence monism. Turner (2011) explores the extreme nihilist view that there are no objects. Sider (2013) embraces what we call *deep nihilism* (see §6.2 below), but it is a delicate question whether he is committed to the nihilist thesis stated above.

⁽¹⁹⁾ See Liggins (2008) and Contessa (2014); see Korman (2015b: §8.3.3) for criticism. Alternatively, it is open to nihilists to insist that there are tables but that, despite appearances and despite being spatially extended, they are simples (see, e.g., Williams 2006: §5).

⁽²⁰⁾ And those who do acknowledge the conflict are often dismissive of common sense. See Hudson (2001: §3.8), Korman (2014), Osborne (forthcoming), Rose and Schaffer (forthcoming: §4), and Korman and Carmichael (forthcoming) on attempts to debunk common sense about composition.

⁽²¹⁾ See Lewis (1986: 213, 1991: §3.5), Sosa (1999: 142), Jubien (2001: 14n2), Sider (2001: 218, 2004: 680), Rosen and Dorr (2002: §4), Varzi (2003: 213–214), Richard (2006: 173), and Cameron (2007: 116, 2008b: 14). See Korman (2008a) and Rose and Schaffer (forthcoming: §3.6) for criticism.

⁽²²⁾ See Sider (2004: 680–681, 2009: 411–421, 2011: ch. 9), Dorr (2005: §7, 2008: §1), Cameron (2008a: 300–301, 2010a: 256, 2010b: §2), and Rettler (ms); cf. Chalmers (2009: §2). See Korman (2015a: §3, 2015b: ch. 5) for criticism. See Horgan and Potrč (2008: ch. 3) for an alternative compatibilist strategy and Korman (2008b) for criticism.

⁽²³⁾ Van Inwagen (1990: ch. 9). Hoffman and Rosenkrantz (1997: §5.7) and Merricks (2001) defend nearby views. Merricks is often mistakenly cited as endorsing organicism, when in fact he offers no answer to the special composition question and is explicitly noncommittal about which organisms there are and whether there are any inanimate composites; see his (2001: §4.6).

⁽²⁴⁾ See van Inwagen (1990: chs. 10–11) for an attempt to reconcile organicism with ordinary belief. See Tye (1992), Hirsch (1993), Hawthorne and Michael (1996), Sider (2001: 178–180), Merricks (2001: 162–170), Varzi (2002: 64–65), Uzquiano (2004a), and Korman (2009: §3, 2015b: ch. 5) for criticism.

⁽²⁵⁾ See Markosian (2014: 82–83); see his (2014: 86–87) for a response to the objection that the account is objectionably circular.

⁽²⁶⁾ See Markosian (2014: 73); cf. van Inwagen (1981: 123) and Mellor (2008). STP will be a recurring theme: see §4.4, §5.2, and §6.1.

⁽²⁷⁾ Cf. van Inwagen (1990: 47). See Markosian (2014: 84–85) for a response. Similar remarks apply to Koslicki's (2008: 187–188) "restricted composition principle"; see Merricks (2009: §1) for discussion.

⁽²⁸⁾ See Mellor (2008: 68), Williams (2008: §6), Gilmore (2013: §4), and Markosian (2014: 73–74) for discussion.

⁽²⁹⁾ See Carmichael (2015: §2 and §3.3) for more on unity-imposing events.

⁽³⁰⁾ See van Inwagen (1990: ch. 7), Silva (2013), and Carmichael (2015: §3) for more on series-style answers.

⁽³¹⁾ See also Hestevold (1981: §3), Rose and Schaffer (forthcoming), and Korman and Carmichael (forthcoming) for a discussion of a teleological answer to the special composition question, and whether it delivers a commonsense ontology.

⁽³²⁾ See Cartwright (1975: 167), Quine (1981: 13), Van Cleve (1986: 145), Rea (1998: 354–355), Hudson (2001: 108–112), and Schaffer (2009a: 358n11).

⁽³³⁾ See Korman (2010a, 2015b: ch. 8) for further discussion.

⁽³⁴⁾ The argument was first advanced by Lewis (1986: 212–213) and later defended in greater detail in Sider (1997: §3.1, 2001: §4.9.1) as part of a defense of universalism.

⁽³⁵⁾ See Nolan (2006: 724).

⁽³⁶⁾ An exact cut-off might be characterized as a pair of adjacent cases such that in the one composition occurs and in the other it doesn't. Or it might be characterized as a pair of adjacent cases such that in the one composition *definitely* occurs and in the other it *definitely* doesn't. Either characterization is acceptable for our purposes.

⁽³⁷⁾ The restriction to concrete objects is meant to ensure that numerical sentences aren't trivially false on account of there being infinitely many numbers, sets, and so forth. See Sider (2001: 127).

⁽³⁸⁾ This version of the argument is drawn from Sider (2001: §4.9.1). Lewis (1986: 212) has a somewhat different argument against borderline composition, resting on the principle that if it is indeterminate whether some things compose something then there is something such that it is indeterminate whether they compose it. Van Inwagen (1990: ch. 19) responds to Lewis's argument by denying this principle; cf. Hawley (2002: §5) and Korman (2015b: §9.5). See Carmichael (2011: 317) for an argument in defense of the principle.

⁽³⁹⁾ Cf. Sider (2001: 128–130, 2003) and López de Sa (2006) in defense of the preciseness of the quantifiers. See Sider (2001: 127), Elder (2004: 65), and Korman (2015b: §9.2) on whether the vagueness can be pinned on the concreteness predicate.

⁽⁴⁰⁾ See Markosian (1998a: 237–239), Merricks (2005, 2007), Hawthorne (2006), Nolan (2006: 725–728), Smith (2006), Cameron (2007: 114–117), and Tahko (2009). See Sider (2001: 124–125) and Barnes (2007) for criticism.

(⁴¹) See Hirsch (1999: 149–151, 2002: 65–66, 2008: 376), Koslicki (2003: 116–120, 2008: 34–40), and Barnes (2013).

(⁴²) Eternalists regard ‘exists’ here as “tenseless”. We are bracketing worries about this notion. See Sider (2001: ch. 2) for general discussion of eternalism.

(⁴³) See Hawthorne (2006: 106), Baker (2007: 130–132), Donnelly (2009: §5), and Korman (2010b: §4.1, 2015b: §9.4.1) for further discussion of this strategy.

(⁴⁴) Proponents include Linsky and Zalta (1994, 1996), Williamson (1998, 2002, 2013), and arguably Marcus (1985). The label is due to Williamson, whose preferred formulation is “necessarily, everything is necessarily *something*”; see his (2013: §1.5) on ‘exists’.

(⁴⁵) Cf. Williamson (2013: 21).

(⁴⁶) Cf. Smith (2005), Hawthorne (2006: 106), Woodward (2011: §3), and Williamson (2013: 7n9). While the necessitist strategy resembles the other DEO maneuvers in denying that borderline composition ever gives rise to indeterminacy with respect to what exists, strictly speaking it is B8 that the necessitist denies: since the envisaged DEOs in the grey area are borderline concreta, ‘C’ turns out to be vague. See Gallois (2004: 652) for a structurally similar, neo-Meinongian response.

(⁴⁷) See Williamson (2013: 8).

(⁴⁸) This response is advanced by Effingham (2009), Wake (2011), and Nolan (2014: §5).

(⁴⁹) Though see Schaffer (2009b: §4) on both objections. The argument can be modified in obvious ways to accommodate worries (perhaps having to do with general relativity) to the effect that regions can in principle have different locations. (Even if this region your head now occupies could have had some different location, it’s not the case that it *would* have been in China had your head been in China.) Thanks to Joshua Spencer for helpful discussion.

(⁵⁰) This terminology is due to Saucedo (2011: §2). We are now assuming (*pace* supersubstantialists) that nothing occupies itself and, thus, an expansion cannot be a region.

(⁵¹) See Carmichael (2011) and Saucedo (ms).

(⁵²) An alternative (endorsed by Saucedo (ms)), which we will not pursue here, is to embrace unrestricted expansionism, the thesis that pluralities of objects *always* have an expansion.

⁽⁵³⁾ Suppose D^*p . Then we have: $DDp \ \& \ DDDp \ \& \dots$. Therefore, every conjunct of the conjunction $Dp \ \& \ DDp \ \& \dots$ is definitely true, so $D(Dp \ \& \ DDp \ \& \dots)$. The result, DD^*p , follows by the definition of D^* . Cf. Williamson (1994: 160).

⁽⁵⁴⁾ See Carmichael (2011: 321–324) for further discussion of this sort of reply.

⁽⁵⁵⁾ Though others may be unfazed by this result. Indeed, this is already a commitment of the standard account of the vagueness of singular terms like ‘Tibbles’; see Lewis (1993).

⁽⁵⁶⁾ An object x is an expansion *simpliciter* iff it is definitely the case that there are ys such that x occupies the region jointly occupied by the ys .

⁽⁵⁷⁾ We borrow the names from Paul (2006: 625).

⁽⁵⁸⁾ This supposition is hotly contested in the literature. Dissenters include Ayers (1974: 128–129), Gibbard (1975: §5), Lewis (1976, 1986: §4.5), Price (1977), Tichý (1987/2004: §3), Heller (1990: §§2.4–7), Noonan (1991, 1993: §1), Burke (1994), Rea (2000), Jubien (2001: 7), Mackie (2007), and Fara (2008, 2012: §2).

⁽⁵⁹⁾ See Doepke (1982: 51), Baker (2000: 181), Lowe (2000: 17), and Paul (2006: 653). See Wasserman (2002: §§1–2) for discussion.

⁽⁶⁰⁾ Perhaps the envisaged colocationist can insist that Athena and Piece (and Nail and Piece_N) decompose into distinct colocated parts “all the way down”; see Wasserman (2002: §1) for discussion.

⁽⁶¹⁾ As in Gibbard (1975: 190).

⁽⁶²⁾ Four-dimensionalists will typically deny Distinctness in such cases, opting for a counterpart-theoretic account of the apparent modal differences; see Lewis (1986: §4.5) for discussion.

⁽⁶³⁾ Neither being Athena-shaped nor being Piece-shaped is a modal property; they’re just determinable shapes.

⁽⁶⁴⁾ See Fine (1999, 2008), Koslicki (2008), and Sattig (2015: ch. 1); cf. McDaniel (2001) and Paul (2002: §5, 2006). See Johnston (2006) and Rea (2011) for nonmereological varieties of hylomorphism.

⁽⁶⁵⁾ Other putative differences that stand in need of explanation can plausibly be explained in terms of the modal and sortal differences. For instance, it may be that Athena but not Piece is well made (see Fine 2003: 206), and the explanation of this difference is that Athena but not Piece is a statue and what it is for a statue to be well

made is different from what it is for a piece of clay to be well made. Cf. Bennett (2004: 341).

⁽⁶⁶⁾ See, e.g., Merricks (2009: §3) and Sidelle (2014: §4).

⁽⁶⁷⁾ This is not to say that *all* mereological facts are bedrock, or that there is no answer to the special composition question. Rather, the claim is that there is sometimes no answer to questions of the form: in virtue of what is *x* a part of *y*? That is, there is no answer to Markosian's (2014: 72) "Question about Parthood".

⁽⁶⁸⁾ Wasserman (2002: 210–211) considers the question and immediately dismisses it: "it would seem plausible for the temporal parts theorist to deny that there is any interesting explanation to be given here: the difference in temporal parts ... is simply a brute fact, not admitting of further analysis or explanation."

⁽⁶⁹⁾ Contrary to Markosian (2014: §3), who objects that this is incompatible with the possibility of gunk. See §6.1 below for more on gunk.

⁽⁷⁰⁾ Alternatively, one might suggest that mereological facts are not explained in terms of location *alone* and embrace only a modified form of STP_{RTL}:

STP_{RTL}* If (i) the region occupied by *x* is a subregion of the region occupied by *y*, and (ii) *x* has some significant causal effect on *y*, then *x* is a part of *y*.

See Mellor (2008). But this thesis has problems of its own (see Williams 2008: §7).

⁽⁷¹⁾ See Schaffer (2003, 2010: §1.2), Cameron (2008c), and Orilia (2009) on the supposition that there must be a fundamental level. See Fine (2001), Rosen (2010), and Schaffer (2009a, 2010) for more on fundamentality and associated priority relations. See Hofweber (2009) and Wilson (2014) for skepticism about these sorts of appeals to fundamentality.

⁽⁷²⁾ See, e.g., Markosian (2005: §3), Cameron (2014: §3), and Skiles (2015: §3). See Holden (2004: ch. 4) for some historical context.

⁽⁷³⁾ The problem we are about to discuss arises even on the much weaker thesis that there is *some* object all of whose parts have proper parts; there is no need to suppose that every object is gunky.

⁽⁷⁴⁾ The argument is due to Schaffer (2010: §2.4). See Cameron (2007), Miller (2009), and Sider (2013: §10) for discussion of whether such assumptions are indeed necessary if true.

⁽⁷⁵⁾ See Bohn (2009), Schaffer (2010: 64–65, 2014: §3.2.3), and Watson (2010) for discussion of JT. See Schaffer (2010: §2.2) for further motivations for monism.

⁽⁷⁶⁾ See Hudson (2001: §3.5), Williams (2006), and Sider (2013: §§9–10).

⁽⁷⁷⁾ Cf. Markosian (1998b: §4) and Lowe (2000: 20) against the proposal that simplicity entails indivisibility. See Holden (2004: §2.3) for some historical context.

⁽⁷⁸⁾ Cf. Williams (2006: 504–506) and Saucedo (2011: §6).

⁽⁷⁹⁾ Such as that found in Schaffer (2010: 61–62).

⁽⁸⁰⁾ See note 22 for references.

⁽⁸¹⁾ See Hawthorne and Cortens (1995: §3), Horgan and Potrč (2008: §3.2), and Sider (2009: §§7–10, 2011: ch. 1).

⁽⁸²⁾ There is room for skepticism about whether this sort of stipulative introduction of the existential_O quantifier succeeds in fixing any meaning for the quantifier. See Korman (2015b: §6.2).

⁽⁸³⁾ This and similar claims really need to be stated more cautiously, perhaps in terms of what the quantifier *purports* to range over, or perhaps metalinguistically: a sentence of the form ‘a exists_O’ is true just in case ‘ $\exists_{Ox}(x=a)$ ’ is true, where ‘ \exists_{O} ’ is the existential_O quantifier. For it may be that what exists_O “outstrips” what exists, in which case one had better not commit to (the existence of) the domain of existential_O quantifier.

⁽⁸⁴⁾ McDaniel (2010a: 644) maintains that identity cannot be fundamental, but his argument rests on the questionable premise that facts about the exemplification of fundamental relations cannot supervene on any other facts.

⁽⁸⁵⁾ Cf. Schaffer (2009a: 372).

⁽⁸⁶⁾ See Cameron (2010a: 262–263).

⁽⁸⁷⁾ See Korman (2015a: §4, 2015b: ch. 6) for further discussion.

⁽⁸⁸⁾ Cf. Sider (2013: §1).

⁽⁸⁹⁾ *Pace* Schaffer (2009a: 361), who says, “When the mereological nihilist denies that fusions exist, what she is denying is that such entities *ultimately* exist—she is denying that such entities are fundamental.” Contrast van Inwagen (1990: 99–100): “My position

vis-à-vis tables and other inanimate objects is simply that there are none. Tables are not defective objects or second-class citizens of the world; they are just not there at all.”

(⁹⁰) See Korman (2011) for an overview of these motivations for eliminating ordinary composites.

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