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PROPOSITIONS AND PARTHOOD: THE UNIVERSE AND ANTI-SYMMETRY

Chris Tillman and Gregory Fowler

It is plausible that the universe exists: a thing such that absolutely everything is a part of it. It is also plausible that singular, structured propositions exist: propositions that literally have individuals as parts. Furthermore, it is plausible that for each thing, there is a singular, structured proposition that has it as a part. Finally, it is plausible that parthood is a partial ordering: reflexive, transitive, and anti-symmetric. These plausible claims cannot all be correct. We canvass some costs of denying each claim and conclude that parthood is not a partial ordering. Provided that the relevant entities exist, parthood is not anti-symmetric and proper parthood is neither asymmetric nor transitive.

Keywords: mereology, singular propositions, absolute generality

1. Introduction

Suppose that the universe exists. *The universe* is intended here in the most inclusive sense: a thing such that absolutely everything is a part of it.[1] It's helpful to have a name for it. Assuming there is a unique such thing, let's name it *U*. According to a popular view of semantic content, *U exists* semantically encodes a singular, structured proposition that has U itself as a constituent as well as the property of existing.[2] By hypothesis, this proposition is a proper part of U. But U is in turn a proper part of the relevant proposition.[3]

This raises a puzzle about parthood. The research program in mereology, the study of the part–whole relation, aims to discover what sort of partial ordering parthood is.[4] But our assumptions are incompatible with two core principles of mereology: antisymmetry of parthood and asymmetry of proper parthood.[5] So if our assumptions are correct, parthood is not a

[1]We will use italics for quotes and bold italics for corner quotes. We will also use italics to italicize.
[2]More generally, instances of the schema ***U is F*** semantically encode a singular, structured proposition that has U itself as a constituent as well as the relevant property. If you doubt existence is a property, feel free to substitute an uncontroversial example.
[3]This assumes that for any x, if x is a constituent of a proposition p, then x is a part of p. (More on this below.) If x is a part of p and x is distinct from p, then x is a proper part of p.
[4]A relation R is a partial ordering iff R is reflexive, transitive, and antisymmetric.
[5]Antisymmetry of parthood says that that for all x,y if x is a part of y and y is a part of x, then x = y. Asymmetry of proper parthood says that that for all x,y if x is a proper part of y, then it's not the case that y is a proper part of x.

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partial ordering and proper parthood is not a strict partial ordering.[6] Mereology is non-well-founded.[7]

Nearly everyone who works on mereology accepts antisymmetry of parthood and asymmetry of proper parthood, and many metaphysicians take these principles to be partly *constitutive* of the relevant notions [Simons 1987; Koslicki 2008; McDaniel 2009]. Many also hold that the universe exists and that sentences such as *U exists* express singular, structured propositions. But if the argument above is sound, these three claims cannot be consistently maintained. What to do?

In the remainder we offer a defence of the soundness of our argument, but we begin with some terminology. Let's say that something is a *complex* just in case it has (proper) constituents, where having constituents does not entail having parts. Let's say that something is *mereologically complex* just in case it is complex and each of its constituents is a *part* of it. Plausibly, U and the property of existing are constituents of the following entities, provided that such entities exist: the proposition that U exists, the state of affairs of U's existing, the truthmaker for *U exists*,[8] the complex property *being such that U exists*, and the ordered pair $<$U, *existing*$>$.[9] Thus, these are complexes and, if their constituents are parts of them, they are mereologically complex. One way to avoid non-well-founded mereology is to deny that there are complexes. Another is to accept complexes but deny that they are mereologically complex. More conservatively, one might accept the mereologically complex but deny that 'trouble-makers' like U exist.[10] We'll consider each option in turn.

2. In Defence of Complexity

It is plausible that if there are non-empty sets, structured propositions, states of affairs, truthmakers, or complex properties, then there are complexes.[11] Consider propositions. An opponent of the view that propositions are complex denies that propositions of the form $<$**o is F**$>$ have **o** as a

[6]A relation R is a strict partial ordering iff R is irreflexive, transitive, and asymmetric.

[7]We assumed that there is a unique thing such that absolutely everything is a part of it. Suppose you reject that. Then you hold that more than one thing has everything as a part. Anyone who accepts that there is a universe but denies that there is only one is committed to the denial of asymmetry in virtue of that fact. Suppose that there are two universes, U and U′. Since U and U′ are universes, absolutely everything is a part of each of them. So, U is a part of U′ and U′ is a part of U. But since they are two, U is distinct from U′ and U′ is distinct from U. Therefore, U is a proper part of U′ and U′ is a proper part of U.

[8]One might take the truthmaker for *U exists* to be some big conjunctive state of affairs concerning a number of U's parts. One who does so might then go on to deny U is a constituent of the truthmaker for *U exists*. (Thanks here to an anonymous referee.) We don't think it is *obvious* that the truthmaker for *U exists*, provided there is such a thing, has U as a constituent. But it's pretty plausible. For instance, it is plausible that truthmakers are facts and that (e.g.) the fact that Obama is human has Obama and the property of being human as constituents.

[9]That there is such a pair violates constraints on classical set theory. One might offer an argument for non-well-founded set theory that parallels the argument for non-well-founded mereology above. We don't pursue this line since we think the case for the existence of problematic complexes is stronger than the case for the existence of the problematic set.

[10]These are not, strictly speaking, the only options. We'll discuss some others below. Some we'll completely ignore.

[11]We are not concerned here with whether 'ordinary' material objects are complex. We are concerned with the sorts of entities listed above. We focus on the special case of propositions, but some of what we say generalizes to other entities on the list. (Thanks here to an anonymous referee.)

constituent. A proponent of the view that propositions are complex holds that propositions exist and that if they exist, they are complex in virtue of having a certain structure.[12] There are two sorts of arguments in favour of propositional complexity: arguments from philosophy of language and arguments from metaphysics. In what follows, we rehearse some samples of each.

If a proposition is structured, then it has constituents. If it is singular and structured, then it has constituents and among them are 'ordinary' objects (as opposed to properties, propositional functions, or Fregean senses).[13] Arguments that some natural language sentences encode singular, structured propositions are familiar.[14] Here's an example: the proposition that Frege was German essentially involves Frege himself in a way that the proposition that the father of modern logic was German does not. The best explanation of his essential involvement is that the proposition in question is singular and hence has Frege himself as a constituent. Here's another:[15] we can consider the proposition with respect to Frege that *he* was German. What we're asked to consider is the proposition that would be asserted by an appropriate utterance of *He is German* or Frege's own utterance of *I am German*. The only legitimate candidate for what we're asked to consider is the relevant singular, structured proposition. Or we may consider the proposition with respect to an arbitrary object x that x is German. This assumes that for any x, a proposition exists that requires for its truth that x, whatever or however it is, is German. These things are singular propositions. We conclude that repudiating complexes amounts to denying that there are propositions.[16]

The case for the existence of complexes need not rest on arguments from the philosophy of language. Even opponents of the view that natural language sentences containing proper names semantically encode singular, structured propositions are willing to admit they exist. It's easy to see why if, like David Lewis [1986a: 57–9], you suppose that they are ordered n-tuples of the relevant sort.[17] Or perhaps, like Richard Cartwright [1997: 76], you're agnostic about whether *Frege was German* encodes a singular, structured proposition, but you believe in the existence of that proposition. Or perhaps, like Stephen Schiffer [2003: 96], you repudiate the need for such entities for the philosophy of language but you welcome the work they do in the metaphysics of modality. And even those who reject such propositions are often ready to admit that there are *other* complex entities, like states of affairs, truthmakers, complex properties, etc., that could serve in our main argument in place of the singular, structured proposition that U exists. To

[12]See Soames [1987] for a classic defence of structured propositions. See also Richard [1990] and King [2001].
[13]This is a bit of stipulation of how we intend to understand the technical terms *singular proposition* and *structured proposition* for the purposes of our argument.
[14]See especially Kaplan [1977], Kripke [1980], Salmon [1986] and Soames [2002]. For an overview see Fitch and Nelson [2007].
[15]This sort of argument appears in Salmon [1986] and Cartwright [1997].
[16]We do not take these arguments to be irresistible. But our main goal is not to present a case for structured propositions, but rather a *prima facie* case for the plausibility of our premise that propositions are complex.
[17]Lewis [1986b] objects to structures on mereological grounds, but the grounds are different from those offered here.

deny that *any* such complex entity exists seems too extreme.[18] We will henceforth assume that there are complex entities of the relevant sort.

3. In Defence of Complexity as Mereological Complexity

As noted, one may accept mere complexity (the existence of entities with constituents) while rejecting mereological complexity (constituents are parts). But we think the presumption should be in favour of the view that constituents are parts. Structured propositions are wholes that *include* objects, properties, and relations. The presumption should be that these included entities are parts. Like Lewis, we find unmereological composition mysterious. We depart from Lewis, however, by refusing to take the axioms of classical extensional mereology (transitivity, uniqueness of composition, and unrestricted composition) as definitional of *parthood*.[19] Instead, we should look for cases of composition and devise a theory of parthood that fits the data, rather than take classical extensional mereology as given and try to explain away apparent cases of composition that violate its axioms.[20] Since we also note that, in common parlance, *parthood* applies to propositions, we join Lewis in thinking that some propositions are literally parts of other propositions.[21] If we assertively utter *Frege was German* and you assertively utter *Nietzsche was German*, then what we assert about Frege is what you assert about Nietzsche, and part of what we said is literally part of what you said. So it seems constituents of propositions are parts of propositions. Thus, since it is plausible that there are complexes, and if there are complexes there are mereological complexes, there is a good *prima facie* case for thinking that constituents of propositions are parts of propositions.[22,23]

[18]One might also deny that *U* functions as a Millian proper name for the world. Anti-Millians may take this line because they hold that no proper name is a Millian proper name. Millians may take this line if they hold that one must be acquainted with an individual in order to introduce a name for it, and we're not acquainted with the relevant individual. We hope it is clear why this response is hopeless. At best it would show that our argument didn't express what we took it to express. It would not make the problem go away as long as the relevant proposition (or suitable complex entity) exists.

[19]Reflexivity and antisymmetry follow from these theses, so classical extensional mereology is committed to the claim that parthood is a partial ordering and that mereology is well-founded.

[20]Here we are sympathetic with Smith [2009].

[21]More carefully, Lewis [1986a] identifies propositions with sets. And Lewis [1991] says that sets have parts. We should be clear that we only agree superficially with Lewis. Lewis's account gets the facts about propositional parthood wrong. Suppose propositions ***P*** and ***Q*** do not have the same intension. Then on Lewis's account, the proposition ***P&Q*** is a proper part of the proposition ***P*** and a proper part of the proposition ***Q***. This is intuitively backwards, and is a result of Lewis's account of propositions as unstructured sets of worlds. Also, on Lewis's account, the sets that are propositions do not have their elements as parts. (Thanks to an anonymous referee here.) The account of propositions we favour differs drastically from Lewis's account. But we share at least one view: propositions are parts of other propositions. We think it is a (perhaps weak) point in favour of this view that proponents of such diverse accounts of propositions endorse it.

[22]One might also follow McDaniel [2009] in citing the Humean stricture forbidding necessary connections between distinct entities as motivation for the view that complexity is mereological complexity. If Obama must exist provided the proposition that Obama exists exists, then there is a necessary connection between distinct entities: Obama and the proposition that Obama exists. This is a violation of Humeanism. The Humean avoids the problem if Obama is a part of the proposition. Then Obama and the proposition are distinct but they overlap, which is enough to satisfy Hume's dictum.

[23]This claim implies that propositions are fusions. (Something is a fusion of some things just in case it has each of those things as parts and each of its parts overlaps at least one of those things.) According to King [2007: 9], if propositions are fusions, then there is no principled way of saying which fusions are propositions

Another consideration militates in favour of the view that constituents are parts. Suppose otherwise. Then Obama is not a part of the proposition that Obama exists, nor is the property of existing. The proposition that Obama exists is, on this account, mereologically simple; it has no proper parts. Now suppose that unrestricted composition is true: any things compose a thing. Given that there are simples, unrestricted composition guarantees that there are strictly more objects than there are simples.[24] If there are n simples, then unrestricted composition guarantees that there are at least $2^n - 1$ objects.[25] Since $2^n - 1$ is strictly greater than n for any n, unrestricted composition guarantees that if there are some simples, there are strictly more things than there are simples.

Recall the assumption that constituents are not parts and that structured propositions, like the proposition that Obama exists, are mereologically simple. If propositions are mereologically simple, unrestricted composition guarantees there are more objects total than there are propositions. But for any x, there is a structured proposition that x exists. And if x and y are distinct, so are the propositions that x exists and that y exists. So there is at least one structured proposition for each thing. It follows that not all of the following can be true: (i) there are structured propositions that are mereologically simple, (ii) there is a 1–1 mapping from things to such propositions, and (iii) any things compose a thing.[26]

It would be pointless to accept structured propositions but deny that for any x, the proposition that x exists, exists. If it's a thing, it exists. So it's true that it exists and *it exists* is true. Part of the motivation for thinking that there are propositions is to make sense of this.

One could also deny that there is a 1–1 mapping from things to such propositions by denying that if x and y are distinct, so are the propositions that x exists and that y exists. According to the Stalnaker–Lewis view of propositions [Lewis 1986a; Stalnaker 1984], propositions are unstructured sets of possible worlds. On this view, in many cases x and y are distinct but ***x exists*** and ***y exists*** encode the same proposition. Consider, for example, Obama and Obama's singleton. Call the latter *Larry*. Obama is distinct from

and why certain fusions have truth conditions, can be objects of attitudes, etc., while others cannot. We do not find King's argument convincing. To be a fusion is to be a thing. As van Inwagen [2006] points out, if something exists, it is a part of itself. And anything with parts is a fusion. But now consider the following argument:

> If propositions are things, then there is no principled way of saying which things are propositions and why certain things have truth conditions, can be objects of attitudes, etc., while others cannot.

But by our lights, a good (partial) response to this argument is that *what it is* to be a proposition is to be the sort of thing that has truth conditions, can be an object of attitudes, etc. A candidate for a more complete answer is King's theory of propositions.

[24]Provided there is more than one thing. (Thanks to Joshua Spencer here.)

[25]For suppose there are only two simples: a and b. Then there are at least three objects: [a] (a thing with a as its sole part), [b], and [ab] (a thing with a and b as its only proper parts). Suppose there are three simples: a, b, and c. Then there are at least seven objects: [a], [b], [c], [ab], [bc], [ac], and [abc]. And so on. (As is standard, we assume here that $n \geq 1$.) Note that if composition is identity, we may get a different result: [ab] = the plurality [a], [b]. It is 'them', non-distributively, so to speak. We are agnostic about whether on this view a 'plural' proposition of the form $<$[ab], $\boldsymbol{F}>$ 'really is' the proposition $<$[a], $\boldsymbol{F}>$ and $<$[b], $\boldsymbol{F}>$ and instead assume without argument that composition is not identity. (Thanks here to an anonymous referee.)

[26]This argument is inspired by the argument Rosen [1995] uses to expose an inconsistency in Armstrong's theory of classes as states of affairs.

Larry; one is a set and one is not. But the proposition that Obama exists is, on the Stalnaker–Lewis view, the set of worlds that include Obama. Since this is the same set as the set of worlds that include Larry, there is not a 1–1 mapping of objects to propositions on the Stalnaker–Lewis view. This way out should be unattractive for familiar reasons, though. Part of the appeal of structured propositions is that they allow us to distinguish between attitudes towards Obama and attitudes towards Larry in a way that the Stalnaker–Lewis view does not.[27]

We conclude that if there are structured propositions, then there is a 1–1 mapping from things to some such propositions (e.g., from any thing to the proposition that that thing exists).[28] So we take the remaining live options to be (i) denying that structured propositions are mereologically simple, or (ii) rejecting unrestricted composition.

It's worth noting that simply rejecting unrestricted composition is not quite enough. The role of unrestricted composition in the argument was to *guarantee* that there are strictly more things than there are mereological simples. Any restricted principle on which there are strictly more things than there are mereological simples will also be inconsistent with the view that structured propositions exist but are mereologically simple. We conclude, then, that the constituents of structured propositions are parts of those propositions.

4. Rejecting the Universe Assumption

Let's take stock. We argued at the outset that if the universe (U) is a proper part of the proposition that U exists, then since that proposition is a proper part of U, mereology is non-well-founded. One reply is to deny that there is a singular, structured proposition that U exists by denying that there are singular, structured propositions. We countered that (i) there are reasons for thinking singular, structured propositions exist, and (ii) singular, structured propositions are not required to generate the problem for well-founded mereology. All that is required is that there are complex entities of the relevant sorts, and that these complex entities are mereologically complex, and we argued that the denial of complexes is too extreme.

Next we argued that if there are complex entities, then there are *mereologically* complex entities. We focused on the case of structured propositions. We said that there should be a presumption in favour of taking complexes to be mereologically complex: on the simplest theory of constituents, constituents are parts. We also pointed to some evidence from ordinary parlance for taking propositions to be things with parts. Finally,

[27]See Soames [1987, 2008] for criticisms of propositions as sets of truth-supporting circumstances.

[28]Our case for there being such a 1–1 mapping relies on intuitions according to which propositions are abundant and fine-grained. Some may be suspicious of our case on the grounds that similar intuitions lead to apparent paradox. Consider the intuition that there is a distinct proposition corresponding to each plurality of things. If this intuition is correct, there are at least as many propositions—and hence at least as many things—as there are pluralities of things. But if there are n things, there will always be 2^n pluralities of things. And 2^n is strictly greater than n, for any n. (Thanks here to anonymous referee. See McGee and Rayo [2000] for a similar line of reasoning.) It would take us too far afield to adequately address this sort of worry here. For further discussion, see Spencer [forthcoming].

we argued that anyone who accepts unrestricted composition and structured propositions must, on pain of contradiction, hold that constituents are parts. More generally, anyone who holds that there are strictly more things than simples must, on pain of contradiction, hold that if propositions have constituents, then those constituents are parts. We concluded that there are reasons for thinking (i) singular, structured propositions exist, and (ii) structured propositions are mereologically complex entities.

Instead of denying that mereologically complex entities of the relevant sorts exist, however, one might deny that the universe (U) exists. The existence of U is entailed by unrestricted composition (for any xxs, there is a y such that y is a fusion of the xxs). So commitment to U can be avoided by rejecting unrestricted composition. But rejecting unrestricted composition is not enough on its own: it avoids *commitment* to U but is compatible with the existence of U. For example, one who holds a restricted view of composition could consistently introduce the existence of U as a separate postulate rather than deriving it from unrestricted composition.[29] Alternatively, she might hold that some things compose a thing iff they satisfy condition C, where absolutely everything satisfies C. So what we really need are reasons for thinking that U does not exist. Perhaps the argument above is reason enough. If so, the upshot of the argument is that the universe does not exist and, as a corollary, unrestricted composition is false.

4.1 Restricting Parthood: Fusions as Commonsense Objects

Many see rejection of unrestricted composition as an easy price to pay: it must be relinquished for reasons independent of well-foundedness in mereology. One might reject unrestricted composition if one baulks at the 'strange fusions' that come with unrestricted composition.[30] If the proposition that U exists is not a deliverance of common sense, then, on this view, U does not exist.

We reject this proposal. First, there are familiar worries about (a) vagueness: since we can say how many things there are in a precise portion of the language, parthood is not a vague matter; and (b) arbitrariness: how is it that the line between thinghood and non-thinghood shapes up in accordance with our classificatory scheme?[31] Second, restricting fusions to denizens of common-sense ontology is no help in avoiding non-well-founded mereology. We think it *is* common sense that someone has asserted or believed something. So propositions exist. We think it *is* common sense that the universe exists.[32]

[29]For example, Markosian [1998].
[30]For example, Koslicki [2008] and Korman [2008, 2010].
[31]See especially Sider [2001] and Hawthorne [2006]. For a reply, see Korman [2010].
[32]Maybe it is common sense that some maximal *concrete* object exists but it is not common sense to suppose something exists that includes all the concreta, all the numbers, etc., as parts. (Thanks here to an anonymous referee.) But if it is common sense that there is a maximal concrete object, then provided there are no hard restrictions on 'inter-category' composition, it is plausible that U exists, too. And there must not be any hard restrictions on inter-category composition if there are singular, structured propositions with ordinary concreta, properties, and even numbers among their parts. So, more carefully: provided it is common sense that some maximal concrete object exists, and there is no law against inter-category composition, it is plausible that U exists.

We know of no good criterion for object-hood delivered by common sense that excludes these.

4.2 Restricting Parthood: Fusions as Concreta

Alternatively, one might hold that parthood is not 'topic-neutral': although there are fusions of concrete objects and there are fusions of non-concrete objects, there are no fusions involving both the concrete and the non-concrete.[33] More generally, for all of the relevant categories, things within those categories have fusions, but things from different categories do not. A related view would hold that only concreta enter into parthood relations; abstracta never do. On these views, U does not exist since it allegedly has absolutely everything—concrete and non-concrete alike—as a part.

We reject this proposal. We think something like the problems of vagueness and arbitrariness arise for the restriction of fusions to concreta as well. First, consider 'multiple' artworks: musical works, photographs, and the like. They bear certain hallmarks of the abstract (they're repeatable, they survive destruction of particular instances) and certain hallmarks of the concrete (they're creatable, we can causally interact with them, they are spatiotemporally located). Aristotelian universals, certain states of affairs and events, impure sets, and any variety of 'singular' complexes have a similar sort of dual nature. Are they concrete or abstract?

Concrete and *abstract* are, to a considerable degree, terms of art. Lewis [1986a: 81–6] considers ways of marking the distinction: The Way of Negation, according to which abstracta lack features possessed by paradigmatic concreta; The Way of Example, where paradigmatic instances of each category are identified, and one is expected to 'continue on from there'; The Way of Conflation, where the distinction is identified with some metaphysical distinction that we have some sort of independent grip on; or The Way of Abstraction, according to which the abstracta are those objects delivered by a suitable 'abstraction' principle.[34]

It is unattractive to maintain that the distinction is primitive.[35] So we will set aside The Way of Example. And any other metaphysical distinction draws the lines in the wrong places. We could consider sets versus individuals, but then propositions, properties, musical works, etc., all end up being just as concrete as tables and cats. We could consider universals versus particulars, but then propositions, sets, musical works, etc., all end up being just as concrete as tables and cats. So The Way of Conflation cannot properly draw the distinction between abstracta and concreta. And, as Gideon Rosen [2001] mentions, fusions of paradigmatic

[33]This is a moral drawn in Uzquiano [2006], which shows that if the field of classical mereology is unrestricted, the cardinality of the universe is $2^n - 1$ while if the field of set theory is unrestricted, the cardinality of the universe is strongly inaccessible. ($2^n - 1$ is not strongly inaccessible for any n.)

[34]See also Rosen [2001].

[35]For arguments to this effect, see Rosen [ibid.].

concreta are also concreta, though the fusion of the Fs = the fusion of the Gs iff every part of every G has a part in common with an F, and *vice versa*. So since fusions seem to be governed by an abstraction principle, The Way of Abstraction yields the incorrect result that fusions of concreta are abstracta.

This leaves us with The Way of Negation, the most popular way of drawing the distinction. The Way of Negation typically identifies abstracta with the non-located or with the causally inefficacious. But as Ben Caplan and Carl Matheson [2004: 133] have argued, there is no 'handbook of universally accepted metaphysical truths' that bars apparent abstracta from entering into causal relations. Finally, it is common to hold that Aristotelian universals are located where their instances are, and perhaps the same goes for impure sets. But these are supposed to be abstract, not concrete!

Of course, we could simply stipulate one or another way of dividing up the abstracta and the concreta. But since many things have hallmarks of both, any such division would be intolerably arbitrary. The distinction does not seem to 'carve nature at its joints'. Perhaps, instead, since there are many ways of 'precisifying' the imprecise terms *abstract* and *concrete*, those words, or the distinction itself, are vague. But if it's vague whether multiple artworks or other 'singular' complexes are concrete, then, if only concreta enter into parthood relations, it's vague whether there are fusions with them as parts. But then the number of things is vague. And we should be wary of tying fusion-hood, which seems to imply something about the number of things, to a distinction that is vague.

Here is our reason for thinking that the problem of arbitrariness arises for the restriction of fusions to concreta as well. Consider Obama and the property of being human. On some views Obama is a 'bundle' of properties that includes the property of being human.[36] On others he has non-property parts in addition to property parts.[37] Now Obama is paradigmatically concrete and the proposition that Obama is human is not. On the view under consideration, the very same ingredients make up both Obama and the proposition. But then the ingredients are parts of Obama but not parts of the proposition. This difference arises solely because Obama is ostensibly concrete while the proposition that he is human is ostensibly abstract. This seems illegitimate. We doubt there is a clear, non-arbitrary distinction between abstracta and concreta.

If we ban inter-category fusions, we risk simply *ruling out* views according to which sets are fusions,[38] ordinary objects are 'bundles' of properties,[39] properties are Aristotelian universals (construed as multiply located objects that are literally parts of other objects),[40] along with neo-Aristotelian views of objects as fusions of 'material' and 'formal' parts.[41] Some of these views

[36]See (e.g.) Hume [1739: Book I, Part I, §vi].
[37]See (e.g.) Fine [1999] and Koslicki [2008].
[38]See Lewis [1991] and Caplan, Tillman, and Reeder [2010].
[39]Or perhaps we should say that the thoroughgoing bundle theorist is a compositional nihilist!
[40]See Armstrong [1989].
[41]See Fine [1994, 1999] and Koslicki [2008] for representatives.

may be worth rejecting. But restricting fusions to concreta rules them out by fiat. This seems illegitimate.[42]

Finally, suppose we accept a ban on inter-category fusions. We think a version of our original argument may still work. Supposing U exists is overkill. We could suppose instead that there is a fusion of all propositions and remain agnostic about U. If propositions are structured, this amounts to the claim that there exists a proposition that has all other propositions as constituents. Assuming there is a unique such thing, let's name it *P*. The argument proceeds as before: P is a proper part of the proposition that P exists and the proposition that P exists is a proper part of P, but P and the proposition that P exists are distinct.

5. The Proper Parthood Assumption

The conclusion that mereology is non-well-founded is avoided if we eschew mereologically complex entities of the relevant sorts. But we fear this is too high a price to pay. Another way out is to reject the claim that the relevant entities (U and other 'trouble makers') exist. We think this route is implausible. Supposing there are entities of the relevant sort, the remaining option is to deny one of the proper parthood premises: either U is not a proper part of the proposition that U exists or the proposition that U exists is not a proper part of U.

We think this option is hopeless. If x is a part of y and x is not identical to y, then x is a proper part of y. Since there's no denying that the proposition that U exists is a part of U and that U is a part of the proposition that U exists, assuming entities of the relevant sort exist, what needs to be shown is that U is distinct from the proposition that U exists. But this is plainly so: U is not a proposition and the proposition that U exists is a proposition. We believe that U exists but it's not true that we believe U. That U exists is true but U itself is not true. Therefore U is distinct from the proposition that U exists.

Some may remain unconvinced that U and the proposition that U exists are distinct. What if *U* itself designates a proposition? If *U* does designate a proposition, then there's a particular proposition it designates. Suppose it's the proposition that U exists. Then we can re-run the original argument by considering a different proposition, e.g. the proposition that U is pink. This is a falsehood, so it cannot be identified with a truth. The argument otherwise proceeds as before.

[42]One might have a different sense of the dialectic. Perhaps rejecting such entities flows from the motivations behind a restriction of fusions to concreta, and these views should be rejected because of the liberal view of composition that they require. (Thanks to an anonymous referee here.) While we think there may be a *sound* argument of the form *composition is restricted to* **F**s, therefore view ***V*** is false, we do not think such arguments will help move the debate forward since we know too little about the true principles of composition. If there are powerful reasons in favour of the premise, this sort of argument may be just fine. But in the absence of such reasons in favour of a view of composition that would rule out the views mentioned, it seems we should evaluate each of these views on their own merits, and not rule them out by fiat.

6. Non-Well-Foundedness and Coincidentalism

Coincidentalists about material objects may notice that arguments for non-well-founded mereology are not new.[43] Some hold that the statue and the clay are distinct and that the clay is part of the statue. Such coincidentalists must reject antisymmetry of parthood and asymmetry of proper parthood on pain of violating the principle of strong supplementation, which says that if y is not a part of x, then y in turn has some part that shares no parts with x.[44] If clay is a part of statue but overlaps the statue entirely, then statue must, in turn, be a part of clay; otherwise we would have to say that statue has some part that shares no parts with clay. So on this view, statue and clay are parts of each other, but they are distinct. So parthood is not anti-symmetric.

We think our argument for non-well-founded mereology is harder to avoid than the classic coincidentalist argument. Recall our argument: very roughly, if the relevant entities exist, then some distinct things are proper parts of each other. But the classic coincidentalist's argument is (very roughly) that if objects coincide, then if strong supplementation is correct, then some distinct things are parts of each other. The latter argument is avoided if strong supplementation is rejected. Not so for the former. But if the argument for non-well-founded mereology is sound, it will not do to reject coincidence on the basis of its seemingly bizarre mereological consequences.

7. Non-Well-Founded Mereology

Here is what you are in for if you agree that the best solution of our puzzle is to embrace non-well-founded mereology. One result is that you must reject weak supplementation for parthood, which is the claim that if x is a proper part of y, then some part of y shares no part with x. For suppose U is a proper part of the singular, structured proposition that U exists. Since U has everything as a part, there is no part of the proposition that U exists that is not also part of U.[45] The anti-symmetry postulate is derivable from weak supplementation plus the reflexivity and transitivity of parthood.[46] So if we accept the reflexivity and transitivity of parthood, we must reject weak supplementation provided we reject anti-symmetry. Many philosophers may find its failure an unacceptable cost, however, since they hold weak supplementation to be true of parthood by definition.[47] As we signalled before, we disagree with these philosophers' methodology. We think should proceed by looking at cases and developing a theory that fits the data

[43]We have in mind Thomson [1983].
[44]Sider [2001: 155]. Sider calls strong supplementation 'PO'. He considers a temporally relativized version of strong supplementation. We omit the temporal relativization.
[45]We assume here that parthood is transitive. If parthood is *in*transitive, weak supplementation may be retained.
[46]See Appendix for proof sketch of Claim 1.
[47]See Simons [1987] for one of the many examples of this sort of view. Koslicki [2008] also makes heavy use of this assumption.

instead of relying on judgments of the intuitive plausibility of a handful of allegedly perfectly general principles.[48]

Advocates of non-well-founded mereology must also give up on the asymmetry of proper parthood.[49] They must give up transitivity of *proper* parthood as well.[50] U is a proper part of the proposition that U exists, and the proposition is a proper part of U, but U is not a proper part of itself.[51] Many hold that transitivity holds for proper parthood by definition. Some certainly hold that transitivity is a hallmark of any fundamental parthood relation.[52] But we are aware of no compelling argument for either claim.[53] We agree that these principles are intuitive; we think they're *very* intuitive. But so is naïve comprehension. We think denying they hold in full generality, while accepting that they hold in practically all cases, and certainly in all standard cases, respects the intuition. We also think it is preferable to the alternatives.

8. Conclusion

We argued that if U exists and is a proper part of the proposition that U exists, then mereology is non-well-founded. We took there to be three main ways to resist non-well-founded mereology: deny there are singular, structured propositions, accept that there are but deny that their constituents are parts of them, or accept that constituents are parts but deny that 'trouble-makers' like U exist. We argued there are good reasons to resist each of these replies: the first is strictly speaking not required; the case for non-well-founded mereology can be made on weaker assumptions. And the second conflicts not only with common parlance and attractive methodological presumption, but also with unrestricted composition as well as the intuitively plausible claim that there are strictly more things than there are simples. The third denies that the universe exists. We tried to explain why we find this option unattractive as well.

Many philosophers think propositions exist. Many philosophers think that propositions are structured and that the constituents of a proposition are parts of that proposition. So it seems that many philosophers should embrace non-well-founded mereology. Bias in favour of antisymmetry of parthood and asymmetry of proper parthood plausibly emerges from cursory reflection on parts of familiar, ordinary objects, or direct reflection

[48]See Smith [2009] for a similar attitude towards Effingham and Robson's [2007] objection to endurantism involving a time-travelling brick composing a wall at a time, thus violating weak supplementation. See also Caplan, Tillman, and Reeder [2010].

[49]See Appendix for proof sketch of Claim 2.

[50]As McDaniel [2009] points out, a parthood relation has a closely associated proper parthood relation that is irreflexive and transitive iff that parthood relation is anti-symmetric. So if parthood is non-well-founded and proper parthood is, by definition, irreflexive, then it must be intransitive. See Appendix for proof sketch of Claim 3.

[51]The intransitivity of proper parthood plus the transitivity of parthood provides another route to the failure of weak supplementation. See Appendix for proof sketch of Claim 4.

[52]See McDaniel [2009: 254].

[53]As suggested above, the allegedly conceptually necessary conditions on fundamental parthood relations simply rule out certain coincidentalist and endurantist views. We do not think coincidentalists and endurantists are conceptually confused about parthood. And we find them good company to keep. *Mutatis mutandis* for the view of singletons defended in Caplan, Tillman, Reeder [2010].

on quite intuitive, but false, general principles.[54] The principles in dispute are not themselves parts of the definition of *parthood*: the world is populated by much stranger things than tables and coffee cups, and perhaps an adequate mereology of these stranger things is non-well-founded.[55,56]

University of Manitoba
Langhorne, Pennsylvania

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[54]Thanks here to an anonymous referee.

[55]We think the most promising options for resisting non-well-founded mereology are either to make the case that constituents are not parts or to hold that there are multiple fundamental parthood relations, one of which is constituent-hood. But we can't think of any good reason to endorse either option, and we accept the arguments set forth in this paper. We suspect taking constituents not to be parts in order to preserve well-foundedness would be rather like insisting that all mammals bear live young by denying that monotremes (like the platypus) are mammals, instead of the correct response (that there are strange mammals which don't conform to our earlier expectations *vis-à-vis* mammals). If it turns out that, contrary to our expectations, good reasons are found for holding that constituents are not parts or that constituent-hood is a sort of parthood distinct from well-founded parthood, we hope that the arguments in this paper can be seen as groundwork for a theory of the otherwise ill-understood notion of constituent-hood. Alternatively, one may be able to preserve analogues of classical principles of minimal mereology by following Gilmore [2009, forthcoming] in holding that the fundamental parthood relation is a *four*-place relation between an object, o1, and its location, l1, and an object, o2, and its location, l2.

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Appendix

Claim 1: The anti-symmetry postulate is derivable from weak supplementation plus the reflexivity and transitivity of parthood.

Proof Sketch: Assume the following:
Transitivity of Parthood: $\forall x \forall y \forall z((x < y \ \& \ y < z) \supset x < z)$
Weak Supplementation: $\forall x \forall y((x < y \ \& \ x \neq y) \supset \ \exists z(z < y \ \& \ \sim \exists w(w < x \ \& \ w < z)))$
Now we assume the denial of anti-symmetry:
$\sim$***Anti-Symmetry:*** $\sim \forall x \forall y((x < y \ \& \ y < x) \supset \ x = y)$
By the denial of Anti-Symmetry and Weak Supplementation, for any *a* and *b* that are parts of each other but are distinct, there is a part of *b* that shares no parts with *a*. Pick an arbitrary such part, *c*. By Transitivity, *c* is also a part of *a*. So it is false that *c* is a part of *b* that shares no parts with *a*. Contradiction.

Claim 2: If parthood is not antisymmetric, then proper parthood is not asymmetric.

Proof Sketch: Suppose parthood is not anti-symmetric and proper parthood is asymmetric. Assume, further, that proper parthood is defined in terms of parthood and distinctness. That is, assume the following:
$\sim$***Anti-Symmetry:*** $\sim \forall x \forall y((x < y \ \& \ y < x) \supset x = y)$
Asymmetry of Proper Parthood: $\forall x \forall y((x < y \ \& \ x \neq y) \supset \sim (y < x \ \& \ x \neq y))$
By the denial of Anti-Symmetry, some *a* and *b* are parts of each other but distinct. But by Asymmetry of Proper Parthood, if *a* is a part of *b* but distinct from *b*, then it's false that *b* is a part of *a* but distinct from *a*. Contradiction.

Claim 3: If parthood is not anti-symmetric, and proper parthood is irreflexive, then proper parthood is intransitive.

Proof Sketch: Assume proper parthood is defined in terms of parthood and distinctness, and, thus, is irreflexive. Assume the denial of asymmetry for proper parthood and transitivity of proper parthood. That is, assume the following:

$\sim$***Asymmetry of Proper Parthood:*** $\sim\forall x\forall y((x < y \ \& \ x \neq y) \supset \sim(y < x \ \& \ x \neq y))$

Transitivity of Proper Parthood: $\forall x\forall y\forall z(((x < y \ \& \ x \neq y) \ \& \ (y < z \ \& \ y \neq z)) \supset (x < z \ \& \ x \neq z))$

By the denial of Asymmetry, there is an *a* and *b* such that they are parts of each other and they are distinct. But, by Transitivity, if *a* is a part of *b* but distinct from *b*, and if *b* is a part of *a* but distinct from *a*, then *a* is a part of *a* but distinct from *a*. Therefore, *a* is self-distinct. Contradiction.

Claim 4: If parthood is transitive and proper parthood is intransitive, then weak supplementation fails.

Proof Sketch: Assume transitivity of parthood, intransitivity of proper parthood, and weak supplementation:

Transitivity of Parthood: $\forall x\forall y\forall z((x < y \ \& \ y < z) \supset x < z)$

Intransitivity of Proper Parthood: $\sim\forall x\forall y\forall z(((x < y \ \& \ x \neq y) \ \& \ (y < z \ \& \ y \neq z)) \supset (x < z \ \& \ x \neq z))$

Weak Supplementation: $\forall x\forall y((x < y \ \& \ x \neq y) \supset \exists z(z < y \ \& \ \sim\exists w(w < x \ \& \ w < z)))$

By intransitivity of proper parthood, there are distinct *a* and *b* such that *a* is part of *b* but distinct from it, and there is a *c* such that *b* is part of *c* but distinct from it, but either *a* is not a part of *c* or *a* is identical with *c*. By transitivity of parthood, if *a* is a part of *b* and *b* is a part of *c*, then *a* is a part of *c*. So it follows that *a* is identical with *c*. Since *b* is a part of *c* but is distinct from *c*, then, by weak supplementation, there is a *d* such that *d* is a part of *c* but *b* shares no parts with *d*. So if *b* is a part of *c* but distinct from *c*, then *d* is a part of *c* but *d* is not a part of *b*. Since *d* is a part of *c* and *a* is identical to *c*, it follows that *d* is a part of *a*. But then, since *a* is a part of *b*, it follows by transitivity that *d* is a part of *b*. Contradiction.