



LUND UNIVERSITY

The ontological parsimony of mereology

Smid, Jeroen

Published in:
Philosophical Studies

DOI:
[10.1007/s11098-015-0468-3](https://doi.org/10.1007/s11098-015-0468-3)

2015

[Link to publication](#)

Citation for published version (APA):
Smid, J. (2015). The ontological parsimony of mereology. *Philosophical Studies*, 172(12), 3253-3271.
<https://doi.org/10.1007/s11098-015-0468-3>

Total number of authors:
1

General rights

Unless other specific re-use rights are stated the following general rights apply:
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Read more about Creative commons licenses: <https://creativecommons.org/licenses/>

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

LUND UNIVERSITY

PO Box 117
221 00 Lund
+46 46-222 00 00

The Ontological Parsimony of Mereology

Jeroen Smid
Lund University

Forthcoming in *Philosophical Studies*, doi: 10.1007/s11098-015-0468-3

Abstract

David Lewis (1991, 84) famously argued that mereology is ontologically innocent. Many who have considered this claim believe he was mistaken. Mereology is not innocent, because its acceptance entails the acceptance of sums, new objects that were not previously part of one's ontology. This argument, the argument from ontological parsimony, has two versions: a qualitative and a quantitative one. I argue that the defender of mereology can neutralize both arguments by holding that, given mereology, a commitment to the parts of an object is not an extra ontological commitment, made in addition to the commitment to the object; and that if the parts of an object are 'ontologically innocent', then sums cannot fail to be innocent either.

Keywords: Mereology, Parthood, Composition, Ontological Commitment, Ontological Innocence.

Introduction

General extensional mereology (I shall refer to this simply as 'mereology' in this paper) is a theory of parthood imposing a rather flat structure on the world: everything is part of something else—except for the universe, which has everything as its part. Moreover, it is possible that everything is infinitely divisible into proper parts (gunk!). This need not be so (if there are atoms), and mereology remains agnostic on the matter. Hence, for mereologists it is not that special to be a proper part of something: virtually everything is. Likewise, being a sum is not so special either; maybe everything is a sum of some things (if parthood relations go 'down' *ad infinitum*).¹

Mereology is controversial given its axiom of unrestricted composition (UMC), which states that for every two or more distinct objects, there is a sum (or fusion)² of exactly those objects. UMC does not seem to be in line with our intuitions about composition. Moreover, it implies an ontological commitment to numerous *new* entities, i.e. entities not previously in the ontology. Mereology therefore appears to be ontologically extravagant.

Is it, though? David Lewis famously argued that mereology is ontologically innocent, despite (or maybe rather because of) UMC (Lewis 1991, 81–87). He took the innocence of mereology to be one of the five respects in which composition is analogous to identity:³ just as commitment to something which is identical to a thing to which you are

¹ For various axiomatizations of classical mereology, see (Hovda 2009). For a general overview of various mereological systems and their philosophical implications, see (Varzi 2015).

² I will use the terms 'sum', 'fusion', and 'composite object' interchangeably.

³ As A. J. Cotnoir (2014, 9) points out, the Composition as Identity thesis comes in at least three versions: Strong Composition as Identity (SCI) holds that the parts taken collectively are *numerically* identical to the whole; Moderate Composition as Identity (MCI) states that the parts taken collectively are *non-numerically* identical to the whole; Weak Composition as Identity (WCI) is the thesis that the parts taken collectively stand in a relation to the whole that is *analogous to* identity. SCI is defended in (Bohn 2014a; 2014b; Wallace 2011a; 2011b; 2014); MCI in (Baxter 1988a; 1988b); WCI in (Lewis 1991; Varzi 2000; 2014). Armstrong (1997, 17-18) defends either MCI or WCI.

already committed is not an extra commitment, so too a fusion is not an extra commitment given your previous commitment to the things that are fused. Most commentators, however, take it that the innocence of mereology is not part of the analogy between composition and identity; they hold, rather, that *if* composition is (analogous to) identity, *then* mereology is ontologically innocent. I will not quarrel over this interpretative issue. I want to focus solely on the notion of ontological innocence in relation to mereology; although I will briefly discuss Lewis's ambiguous position with respect to Composition as Identity and its relation to the ontological innocence of mereology (Section Three).

Mereology is taken to be ontologically extravagant for two distinct reasons, although these are often fused into one. First, we have the argument from *quantitative* parsimony, which goes something like this. Suppose you accept the existence of Tom (a cat) and Jerry (a mouse).⁴ No cat is a mouse and no mouse is a cat, so you accept the existence of *two* distinct entities. If you accept mereology then, given UMC, you are now also committed to the fusion of Tom and Jerry. This means that you now accept the existence of *three* objects. In general:

*The Argument from Quantitative Extravagance (ANE)*⁵

- N1. UMC is an axiom of mereology;
- N2. UMC entails the existence of sums, objects that were previously not in one's ontology;
- N3. These objects are additional ontological commitments;
- N4. Hence, mereology is ontologically more extravagant than theories without UMC.

ANE thus states that after accepting mereology one is committed to a greater *number* of objects than one was previously committed to, and that these additional objects are further ontological commitments (Berto and Carrara 2009).

There is another argument, very much like ANE, which focuses not so much on the *number* of objects, but rather the *kinds* of objects. Assume again the existence of Tom and Jerry. No cat is a mouse, so you accept the existence of two different *kinds* of entity.⁶ If you accept mereology then, given UMC, you are now also committed to the fusion of Tom and Jerry. This fusion is of a mixed kind: it's partly cat and partly mouse, which—allegedly—means that you now accept the existence of a new *kind* of object (Cf. Van Inwagen 2002, 191-192). In general:

The Argument from Qualitative Extravagance (ALE)

- L1. UMC is an axiom of mereology;
- L2. UMC entails the existence of sums, objects that were previously not in one's ontology;
- L3. These objects are (sometimes) of a different ontological kind or category;
- L4. Such a different ontological kind or category is an additional commitment;
- L5. Hence, mereology commits one to *additional kinds* of objects.

So, we have two arguments from ontological extravagance against mereology. Such arguments matter because they engage plausible-looking principles concerning theory-choice. One such principle states that if we can choose between

⁴ Tom and Jerry made their first appearance in the Composition as Identity debate in (Yi 1999).

⁵ I use the acronym 'ANE' for the Argument from *qua*Ntitative Extravagance and 'ALE' (below) for the Argument from *qua*Litative Extravagance.

⁶ Forget for a moment that cats and mice both belong to the kingdom *Animalia*. For the argument we need two objects of two different kinds; we could take whatever objects of whatever ontological kind or category are deemed appropriate, as long as the two are different in kind.

two theories that are equal in all respects except simplicity, we should opt for the simpler theory. The two arguments, ANE and ALE, differ in their understanding of simplicity. One appeals to qualitative parsimony, the other to quantitative parsimony.⁷ Hence, ANE and ALE matter because, if they are sound, and if there are alternatives to mereology that are more parsimonious, then we should—everything else being equal—opt for one of those alternatives.

I proceed as follows. In the first section I will argue that within mereology a commitment to a composite object (a sum) entails a commitment to its parts. Furthermore, the commitment to the parts is not a *further* ontological commitment, given the commitment to the sum. This will be called ‘the Innocence of Parts’ (IP). Surprisingly, within mereology IP entails that composition is also innocent, i.e. ‘the Innocence of Composition’ (IC). In Section Two I use IP and IC to dismantle ANE and ALE. Neutralizing ANE also shows how the defender of mereology can use a similar argument against mereological nihilism. Hence, there is no parsimony argument *against* mereology, though there is one parsimony argument in *favor* of mereology—if one is willing to cheat. In Section Three I compare my verdict with that of Lewis, who also takes mereology to be innocent but seemingly for different reasons; and with that of Hawley, who takes mereology to be innocent only if the axiom of unrestricted mereological composition is a necessary truth. In the final section I discuss my results in the light of Quine’s criterion for ontological commitment, and I suggest that defenders of mereology should adopt a slightly altered version of it.

1. The Innocence of parts within mereology

In this section I argue that the parts of an object are not an ontological commitment that is additional to the ontological commitment to the object. The argument to that conclusion makes use of mereological principles such as the Extensionality Principle. This does not, however, make the argument circular: I argue not that parts are ontologically innocent *tout court*, but only that they are ontologically innocent *within* mereology. This is justified, because when we want to know the ontological commitments of a theory we are entitled to use the principles of that theory to uncover (or diminish) its ontological commitments. To illustrate, when we compare the ontological commitments of two theories, *T1* and *T2*, we are allowed to use the principles available within each theory to identify, or reduce, certain objects within that theory. Say we can reduce one object in *T1* via some rules that are part of *T1*, but that this cannot be done in *T2*. This does not make the move within *T1* illegitimate or unfair: it simply shows what *T1* actually commits us to. Of course, one can object to certain reductions and principles used in the theory—just as one can object to the mereological principles I use. But this is a different discussion which no longer concerns the comparison of different theories with respect to their ontological commitments. Discussing the validity of the mereological principles is legitimate, but not if the question is whether those principles impose further ontological commitments.

Full disclosure: it will become clear during the discussion that, within mereology, counting objects is not the same as counting ontological commitments. This means that someone who accepts mereology has to consider diligently the basis on which she lists (i.e. counts) her ontological commitments; simply counting objects does not work. It also means that arguments from parsimony are hard to formulate against mereology because they assume that counting objects is the same as counting ontological commitments. The conclusion I draw from this is that mereology is invulnerable to (almost all) kinds of parsimony argument. However, an alternative conclusion that could be drawn is that

⁷ Two other notions of simplicity (which will be ignored here for the sake of simplicity) are syntactical simplicity and ideological parsimony.

mereology is in even deeper trouble than the arguments from parsimony suggest: mereology sins gravely against Quinean meta-ontological dogmas, since it provides the means to distinguish counting ontological commitments from counting objects; hence mereology should be abandoned. This latter conclusion, which I shall not discuss here, is not the one I draw. But I should perhaps say that I do not think mereology sins against Quine.

With this disclaimer in place, we can now look at the argument for the Innocence of Parthood. This makes use of the Extensionality Principle, i.e. the following theorem of mereology:⁸

Extensionality Principle (EP): $\forall x \forall y (x = y \leftrightarrow \forall z (PPz \leftrightarrow PPz))$ (where x and y are composite objects.)

EP tells us that identicals have the same proper parts, and that having the same proper parts is necessary and sufficient for identity. It is a controversial principle and comes with ontological consequences: for example, coinciding non-identical objects are banned when EP is accepted. This might count against the innocence of mereology, but as I have said it is irrelevant to an investigation of the number of entities, and the number of kinds of entity, to which mereology is ontologically committed. There is one exception here: we know now that the kind ‘coincident object’ (if it is a kind) is banned from mereology. But banning a kind of object usually makes one’s theory more parsimonious, not more extravagant.

Now imagine Argle, a mereologist who accepts the existence of Tom (a cat with proper parts). Question: Is an ontological commitment to the parts of Tom entailed by ontological commitment to Tom? That is to say: Can Argle consistently accept the existence of Tom while denying the existence of Tom’s parts? Answer: No. To see this, imagine Bargle. Bargle does accept the existence of a cat, Tom*, but he denies that it has parts; hence Tom* is mereologically simple. Nothing that is part of Tom is also part of Tom* since Tom* does not have any parts. Hence, by EP: Tom \neq Tom*. Thus Argle and Bargle are committed to different objects. Argle cannot accept the existence of Tom without accepting the existence of Tom’s parts—otherwise Argle would accept the existence of Tom* or Tom**, or... but not Tom.⁹

Here is another way to make the same point. Imagine Bargle does accept the existence of a cat with proper parts, Tom’. However, Argle and Bargle disagree about whether Tom has Tail as a part. Argle claims Tail is part of the cat and Bargle denies this. Are Argle and Bargle ontologically committed to the *same* object but *different* parts? No: Tom’ \neq Tom, since Tom has Tail as a part while Tom’ does not. In general, in mereology one cannot accept the existence of a composite object (i.e. a sum) without accepting the existence of its parts.

Very well, it might be said, but is the ontological commitment to the parts of an object an ontological commitment *in addition to* the commitment to the object that has those parts? To answer this question we need to know how, exactly, we ontologically commit ourselves to something, and how to *count* our ontological commitments. It seems

⁸ Various extensionality principles, such as Unique Composition, Extensionality of Composition, and Extensionality of Parthood, are valid in mereology. For discussion, see (Varzi 2008).

⁹ Of course, if Argle’s claim that Tom exists is false, whereas Bargle’s claim that Tom* exists is true, we should take sides with Bargle. However, principles of theory-choice are only relevant if there is no way of telling which of the theories on offer is true (or correct): they all explain the phenomena, and therefore we should look at theoretical virtues like simplicity in order to choose. Hence, I will suppose that we do not know (and cannot know) whether mereology is correct. I am only interested in the question whether we should eschew mereology on the basis of a principle of ontological parsimony.

that ontological commitments are related to constraints on the world: the sentence ‘ x exists’ puts certain constraints on the world if it is true. In truth-maker terminology: you are ontologically committed to some thing, y , if y is necessary to make your sentence ‘ y exists’ come out true. An ontological commitment is thus a certain demand you put on the world. This ‘demand talk’ should not be fleshed out in purely modal terms, since then necessarily existing things would be demanded by contingently true sentences, given that necessarily existents exist in all possible worlds. As Rayo puts it:

I shall use demand-talk in such a way that it obeys Kripke-style substitution rules for names and predicates. Thus, since Hesperus is Phosphorus, there is no difference between the demand that the world contain Hesperus and the demand that the world contain Phosphorus. Similarly, since being composed of water just is being composed of H₂O, there is no difference between the demand that human bodies be composed mostly of water and the demand that human bodies be composed mostly of H₂O. (...) The demands imposed on the world by a sentence’s truth are simply the sentence’s truth-conditions. So one’s understanding of the former should be informed by one’s understanding of the latter. (Rayo 2007, 429)

Admittedly, this is still very rough, and we now need to know what a sentence’s truth-conditions are. However, for our purposes it will suffice, since we only need to discuss sentences of the form ‘ x exists’, whose truth-conditions seem to be fairly straightforward: ‘ x exists’ is true iff there is an object in the world that is x .

We can therefore specify our question thus: Are the truth-conditions for ‘ O exists’ (where O is a composite object) different from the truth-conditions of ‘ x, y , and z exist’ (where x, y , and z are the only proper parts of O)? If the truth-conditions are the same, then—given the demand-talk analysis—the ontological commitment of ‘ O exists’ is the same as that of ‘ x, y , and z exist’. Moreover, if the truth-conditions of a sentence S entail the truth-conditions of a sentence S' , then S' can be said to impose no *further* ontological commitments given those of S . Since O cannot exist without x, y and z , the demand placed on the world in order to make ‘ O exist’ come out true is—at least—that x, y , and z exist. Bearing in mind EP, it can be seen that if x, y , and z do not exist, there might be some O' which is very similar to O but is nonetheless not O . (I say ‘at least’, because one might hold that for O to exist it is not sufficient that x, y , and z exist; after all, they have to compose O . But let us forget this for a moment.)

Similarly, for ‘ x, y , and z exist’ to come out as true, x, y , and z must be in the world. What it is safe to say is that ‘ x, y , and z exist’ does not have any truth-conditions not had by ‘ O exists’: if the truth-conditions for the latter are satisfied, then so are the conditions for ‘ x, y , and z exist’. This is what I call the Innocence of Parthood:

The Innocence of Parthood (IP): If you are ontologically committed to O , then, if x is a proper part of O , the existence of x is not an additional ontological commitment over and above your commitment to the existence of O .

IP is justified given the demand-talk analysis of ontological commitment and EP: the parts of the object were already demanded of the world in order for the sentence ‘ O exists’ to be true. Hence, saying that one of O ’s parts exists does not demand something *new* of the world. Nothing that was not demanded already of the world by the truth of ‘ O exists’ is demanded by claiming that ‘ x exists’ if x is part of O .

IP drives a wedge, then, between counting objects and counting ontological commitments: a proper part of a composite object is a different object, but it is not an extra ontological commitment given the ontological commitment to the object. Achille Varzi (2000) makes a rather similar distinction when he proposes the Minimalist View.¹⁰ According to this view, an inventory of the world (i.e. a list of everything that exists) should be complete (list everything) but avoid redundancies (avoid listing overlapping entities).

The Minimalist View says nothing specific about mereology, about what entities are part of what. But, given a mereological theory and a corresponding domain of quantification, the view tells us how to weigh our ontological commitments:

(M) An inventory of the world is to include an entity x if and only if x does not overlap any other entity y that is itself included in that inventory. (Varzi 2000, 285)

Varzi thus proposes that we *countenance* the parts (otherwise mereology has no significance) but not *count* them along with the wholes of which they are parts when we list our ontological commitments. IP says something similar, but it is based more specifically on mereology. By contrast, Varzi seems to think of M as ‘mereologically neutral’. My sense is that M is only sensible given EP, since we do want to say that both the Statue and the Clay have to be in the inventory if someone accepts coincident objects, although the Statue and the Clay completely overlap.

Notice, further, that IP, like M, is silent about composition. This means that anyone who accepts EP can use IP to defend the claim that a commitment to the parts of an object does not increase the number of ontological commitments one is making. That is to say, if someone holds that composition only takes place if some condition ϕ obtains (and hence denies UMC), but also holds that no two non-identical objects can have exactly the same parts (and hence accepts EP¹¹), then she can safely hold that the parts of the ϕ -sums are not an extra ontological commitment *over and above* her commitment to the ϕ -sums. The advocate of mereology—a theory, it will be recalled, with UMC as one of its axioms—can, however, defend an even stronger claim by applying IP. She can hold that mereological *composition* is also innocent:

The Innocence of Composition (IC): If you are ontologically committed to some x s, then, if O is composed of the x s, the existence of O is not an additional ontological commitment over and above your commitment to the existence of the x s.

The argument for IC from IP and mereology is a *reductio*. Assume that IP is true and IC is not. Imagine there is an object O composed of x , y , and z . Argle accepts the existence of O . Given IP, Argle’s commitment to x , y , and z is not an additional commitment, so Argle has one genuine ontological commitment. Now, Bargle accepts the existence of x , y ,

¹⁰ I say ‘rather similar’, since Varzi seems to hold that counting objects is the same as counting ontological commitments: “[I]f (...) commitment to the fusion is *just the same as* commitment to each of those things [i.e. its parts], then on the weak reading of Composition as Identity L3 [i.e. mereology is ontologically innocent] would sin against Quine.” (Varzi 2014, 63) Instead, Varzi suggests that truths about fusions make the same commitments as truths about their parts (Ibid.).

¹¹ EP is crucial here, as it is in Varzi’s M, since without it one cannot hold that the object one is committed to could not exist were it not for the parts it has; and without this latter claim ontological commitment to some composite object O does not entail ontological commitment to its parts.

and z (i.e. three objects). Also accepting UMC, Bargle is committed to an object O composed out of x, y , and z . Since IC is false (by assumption) Bargle has four¹² genuine ontological commitments: x, y, z , and O ; whereas Argle only has one. Obviously, however, Argle and Bargle have the same ontological commitments, so either IP is false or IC is true. Since IP is true, IC is true as well.

Here is another reason for thinking that, given the truth of IP, its converse (IC) must hold as well. IP tells us that when we *decompose* an object into parts, we should not *add*. Pages are not a *second* ontological commitment over and above the commitment to the book; they are part of the book, and I already committed myself to them when I committed myself to the book. Nor is decomposition subtraction: if you decompose the book into the pages and the cover, you should not *subtract* your ontological commitment to the cover from your ontological commitment to the book so that 1 (the book) *minus* 1 (the cover) *equals* 0. We do not deplete our ontological commitments when we decompose! Thus decomposition is neither addition nor subtraction; but then composition is not either, since composition is the converse of decomposition. If counting the parts after counting the whole is double-counting, then so is counting the whole after counting the parts.

The following objection might be made at this point. IP may very well be true, but that is because the demands put on the world for ‘ O exists’ to come out as true entail the demands for ‘ O ’s parts exist’ to come out as true. But the parts of O might very well exist without O existing, since for ‘ O exists’ to come out as true, the parts of O must exist *and* they should satisfy some condition ϕ in order to compose O . This objection is a serious one for anyone who wishes to defend IC and a restricted version of composition. But for someone who accepts UMC, it has no force: given that composition always takes place between two or more distinct objects, the existence of the objects is the only demand made on the world in order for composition to take place. Hence, the existence of the parts of O and the existence of O places the same demand on the world. This is not to say that the composite object is *identical* to its parts (i.e. to affirm the strong Composition as Identity thesis); it is rather to claim that, within mereology, the demand placed on the world for ‘ x and y exist’ to come out as true is the same as the demand placed by the truth of ‘ O exists’ (where O is composed of x and y).

Of course, this defense of IC depends crucially on UMC, but as I said at the beginning of this section this is warranted. We are considering the ontological commitments of mereology, which has UMC as one of its principles. Whether UMC is true, or intuitive, is a different question, but we are entitled to apply it when we consider how to count the ontological commitments of mereology.¹³

2. Getting everything at once

In mereology, ontologically committing yourself to an object is the same as committing yourself to its parts—although (and I cannot stress this enough) this does not entail, nor does it presuppose, that the parts are identical to the whole. What does this mean for the parsimony arguments ANE and ALE? First, the quantitative variant, ANE, which tried to show that mereology is *quantitatively* extravagant.

¹² Actually, given UMC, Bargle has *seven* objects to which he is ontologically committed: next to the four I mention there is also the sum of x and y , the sum of y and z , and the sum of x and z . This does not matter for my argument.

¹³ Cf. footnote 9 above.

Given IP and IC, the mereologist can object to N3, insisting that the sum (or fusion) of two objects should not be counted as an *additional* ontological commitment. In mereology the demands put on the world in order for a fusion to exist are that its parts exist, so there are no additional commitments (although it is also true that one will accept a greater number of objects after adopting mereology than one accepted before this).

Moreover, given IP, the defender of mereology can hold that there is actually an argument from quantitative parsimony in favor of mereology:

The Argument from Quantitative Parsimony (ANP)

- P1. UMC is an axiom of mereology;
- P2. UMC entails the existence of the universe, i.e. one object that has everything else as its proper part;
- P3. Proper parts are not additional ontological commitments (IP);
- P4. Hence, mereology has only one ontological commitment, and this is to the existence of the universe.

ANP tells us that mereology is quantitatively parsimonious, since given mereology one can ontologically commit oneself to everything that exists by accepting the existence of only *one* object: the universe. An obvious objection here is that, if P4 is true, mereology commits us to existential monism, or the view that there is only one object. However, this objection can easily be met. It is true that existential monism also posits only one object. However, the object it posits and the universe postulated by mereology are different kinds of object. Mereology claims that the universe has *parts*, and existential monism¹⁴ denies this: the monistic universe is one, big extended *simple* object.

A more careful formulation of the objection would run as follows. Existential monism posits only one object (the simple universe). But for mereology to be true the universe has to have parts. Hence there has to be more than *one* object: next to the universe, the parts of the universe have to exist. So mereology commits one to more objects than only the universe, and these further objects are further ontological commitments.

This last objection is simply a denial of P3, and hence a denial of IP. But IP is correct, so where does the objection go wrong? Again, the objection is misconceived given that the one universe of mereology is a different ontological commitment than the one universe of existential monism. The same number of commitments is involved, but you commit yourself to different kinds of object depending on whether you accept the mereological universe or the monistic universe. Compare Argle and Bargle again, now discussing the existence of Tail as a part of Tom. If Bargle denies that Tail exists as a part of Tom, and Argle disagrees, Argle and Bargle are committed to different kinds of object that go by the name 'Tom'. Analogously, to accept the universe of mereology is to accept an object that is different in kind from the one we accept when we accept the universe of existential monism. Ontological commitment to the mereological universe entails an ontological commitment to the existence of its parts; ontological commitment to the monistic universe requires us to deny that those parts exist. In this sense mereology permits an answer to Quine's ontological question—"what is there?"—that is different from "everything", but extensionally equivalent to it: "the universe" would be equally correct, "and everyone will accept this answer as true" (Quine 1948, 21). (Though note that "everyone" now means *everyone who accepts classical mereology*.)

¹⁴ Existential Monism should be distinguished from Priority Monism as defended in (Schaffer 2010) which is the view according to which the universe is ontologically prior to its parts.

If this is so, there seems to be an argument from parsimony to mereology: the adoption of mereology makes it possible to have only *one* ontological commitment, a commitment to the one, big universe. However, this is not completely fair, since it is equally correct to say that mereology comes with two ontological commitments: the universe minus you and, as a second commitment, you. In general: any number of objects can be said to be the number of ontological commitments on the mereological view, as long as the objects you count do not overlap and collectively do cover the universe. Given this, there is not much point debating the number of objects the mereologist is committed to when that number is compared with the number of objects in a non-mereological ontology. If sums should not be counted next to their parts, and if parts should not be counted next to their wholes (IC and IP), then partitioning your catalogue of the world in one way gives one number of objects, but partitioning it in another way gives another number. Given IP and IC, there is no *absolute* way of counting ontological commitments within mereology. But if this is the case, it is unreasonable to hold that mereology is the more ontologically parsimonious position: the flexibility of counting within a mereological framework can equally well be used to defend the very opposite. Given that ANP simply exploits flexible counting, I do not think it can be called upon to provide support for mereology. The argument for mereology based on ANP involves cheating, in other words. Nor, however, can ANE be used *against* mereology, because it denies the flexibility of counting the ontological commitments of mereology.

How does the qualitative variant of the parsimony argument, ALE, fare? That argument depends crucially on there being ontological kinds or categories, a notion that is hard to specify. To get an intuitive grasp of what is meant by an ontological category I will give some examples; for each I will show how it would work within ALE. For sake of the argument, I will of course assume that there is some sense in talk about ontological categories. Anyone who holds the view that such categories, or kinds, do not make sense would not be moved by ALE in the first place.

E. J. Lowe (2006) distinguishes between four categories of being: objects (substantial particulars; *this apple*), kinds (substantial universals; *apple*), attributes (non-substantial universals; *redness*), and modes (non-substantial particulars; *the redness of this apple*). If you accept this schema, and you also accept UMC (because you accept mereology), then you have sums that are cross-categorical: the sum of *this apple* + *redness* is partly an object and partly an attribute. Before accepting mereology, you did not have any cross-categorical objects in your ontology, so accepting mereology entails accepting *new kinds* of objects: you are committed to L3 of ALE.

Here is another example. Suppose you accept only tropes and abstract propositions. No trope is part of a proposition, and no proposition is part of a trope. Hence, everything that exists belongs either to the category of tropes (or possibly, bundle of tropes), or to the category mind-independent propositions. Now, given UMC you have a sum of a trope and a proposition, and this sum does not belong—completely—to either category. Hence, this sum is of a different category: again, you are committed to L3 of ALE.

Various other examples could be given. Is the sum of a dog and the Eiffel Tower an animal or an artifact (or neither)? Is the sum of Napoleon's death and the Empire State Building an event, an object, or both? For anyone who believes that an ontology should be free of cross-categorical objects UMC might be problematic. Those who dislike cross-categorical objects could restrict mereology to one category (say, material objects). This is perfectly legitimate, since mereology does not tell us what kinds of object there are, or to what kinds of object its axioms apply. (It is in this sense a formal theory.) If mereology is restricted in this way, ALE ceases to pose a problem—except in two kinds of case: first, the difference between complex and simple (i.e. between objects that have and objects that do not have proper parts).

Second, if mereology is restricted to material objects, say, then one might still say that the sum of Tom (a cat) and Jerry (a mouse) is cross-kind, and hence of a different *kind* (where kinds are natural kinds of some sort). I will come back to the first kind of case below. The second can be covered in a manner analogous to that in which we shall deal with the cross-categorial solution now.

For those who allow cross-categorial objects ALE does seem to have force: accepting mereology entails accepting cross-categorial entities that were (by assumption) previously not there. However, just as with ANE, the defender of mereology can hold that she simply accepts one, big cross-categorial universe, and that the ontological commitment to this (very special?) kind of entity entails an ontological commitment to the other ('pure') categories. So, just as committing oneself to a sum entails a commitment to its parts, so too commitment to a cross-categorial universe entails a commitment to the categories that can be found among the parts of that universe. So, commitment to a cat-mouse fusion entails a commitment to the kind *cat* and the kind *mouse*. It follows that these categories are not *new* ontological commitments. This way of denying L4 is available until we get to the commitment to the universe as the one sum that has everything else as its parts.

This is not to say that mereology does not commit one to *different* kinds of entity. Cross-categorial entities are probably different from pure kinds. However, the point is that these pure categories are not to be counted as additional commitments after accepting the cross-categorial entity that is their sum.

Alternatively, one could hold that fusions that have parts in different categories do not belong in any category; they belong partly to each category to which their parts belong. This would also be sufficient to block ALE, but now by denying L3 rather than L4.

Turning now to the distinction between simple and complex, or between atomic and composite, we must ask: Is mereology not committed to one category more than mereological nihilism? I think the answer is No. Imagine a world, w_1 , consisting solely of atoms (of the mereological kind, i.e. lacking proper parts). Imagine another world, w_2 , also consisting of atoms, but in which atomistic mereology is true, so that there are, next to the atoms, objects composed out of those atoms. As I have said, these composite objects are not, quantitatively, a further ontological commitment. There is, however, a qualitative difference between w_1 and w_2 . The first has only *one* category: atoms. The second has two: atoms and composites. Hence, a defender of ALE could argue that it is better to be a mereological nihilist than to accept mereology, because according to the nihilist there is only one kind of object in the world: atoms.

But now imagine a third world, w_3 , in which *atomless* mereology is true. This is a world, then, in which everything has proper parts. Just as w_1 has only one category of object (simple), so, too, w_3 has only one category (complex). Since mereology is neutral with respect to w_2 and w_3 it is hard to evaluate the claim that the mereological nihilist has one category *less* than the defender of mereology. This claim comes out true if one allows for the existence of atoms (w_2), but false if the world is gunky (w_3). As long as the gunky world is possible, the nihilist cannot say that she has one kind of object less than the mereologist. This means that this version of ALE is also unsuccessful in delivering the conclusion that mereology commits one to more kinds of object than other theories.

3. Innocent but not redundant.

Thus far I have argued that within mereology counting objects is not the same as counting ontological commitments. Given some objects, their parts are not extra ontological commitments (IP). Nor are sums of those objects (IC). This

means that there is no sound argument from quantitative parsimony against mereology. Furthermore, if one accepts cross-categorical objects, or denies that sums of objects belonging to different categories occupy a *new* category, there is no argument from qualitative parsimony against mereology either. Except for the nihilist, that is: if she can show that we cannot deny the existence of mereological atoms, her theory allows for one category less than any theory that incorporates mereology.

However, one might wonder whether it is justifiable to distinguish counting objects from counting ontological commitments when we investigate whether a theory is or is not ontologically innocent. After all, Lewis denies that set theory is ontologically innocent. Is the analysis given above not going to give a different verdict? Is set theory not just as innocent as mereology if we distinguish counting objects from counting ontological commitments? Here is Lewis on set theory:

Set theory is not innocent. Its trouble has nothing to do with gathering many into one. Instead, its trouble is that when we have one thing, then somehow we have another, wholly distinct thing, the singleton. And another, and another... *ad infinitum*. (Lewis 1991, 87)

Is Lewis not mistaken in denying that set theory is innocent, given my analysis? Can it not be sensibly maintained that set theory *is* innocent because the demands placed on the world by the existence of a singleton are the same as those placed on the world by the existence of its sole member? Such a move *might* be successful, and if it is set theory cannot be rejected by appeal to ontological parsimony.¹⁵

If Lewis does indeed think that mereology is ontologically innocent but set theory is not, then it might be that he does not—as I do—reason along the lines of IP and IC.¹⁶ In that case Lewis probably takes counting objects to be the way to count ontological commitments, which means he would need something like Composition as Identity to back-up his claim that mereology is ontologically innocent. This would indeed give the right result for set theory: this theory is not ontologically innocent since the singleton is not identical to its single member. However, with respect to mereology it matters what version of Composition as Identity Lewis has in mind. It is commonly thought that *weak* Composition as Identity (the view that composition is analogous to identity) is not sufficient to back up the claim that mereology is ontologically innocent. Only the strong version of Composition as Identity (the view that composition *is* the many-one identity relation) is strong enough to guarantee that mereology is ontologically innocent (if counting objects is the way to count ontological commitments). But Lewis seems reluctant to accept this latter position for “what is true of the many is

¹⁵ It may be a problem for such a procedure that the singleton has to be something different from the object that is its single member. Claiming that the singleton should not be counted next to its sole member makes set theory impossible (likewise for the singleton of a given singleton). You have to take the singleton as something else *and* count it next to its member; but no such demand is made by mereology. In mereology you need not (and cannot) get something new out of only one thing (the sum of Lewis is just Lewis, not singleton-Lewis). You do get something ‘new’ out of the many in mereology, namely the sum of the many. But, as I have said, this should not be counted as a new ontological commitment. Moreover, in set theory the set of two objects is different from the *ordered* set of those same two objects. Thus, set theory is not as hyper-extensional as mereology—which might make it less obvious that something like ‘Innocence of Membership’ (as analogous to ‘Innocence of Parthood’) can be defended *and* that such a principle would be sufficient to defend ‘Innocence of Set-Formation’ (as analogous to ‘Innocence of Composition’). (Defending the latter principle might be further hindered by the fact that there cannot be, on pain of paradox, be a set of everything in set theory, whereas there is a sum of everything in mereology, viz. the universe.)

¹⁶ Thanks to an anonymous reviewer for pressing me on this point.

not exactly what is true of the one.” (1991, 87) The fact that Lewis (1991, 81) talks of the “same portion of Reality” does not make it easier to settle this interpretative issue: how should ‘portions’ be counted? It is clear that IP and IC—just as Varzi’s M—provide guidelines on how to count portions (viz. do not count overlapping portions twice), which gives reason to think that Lewis *does* reason along the lines of IP and IC. However, this also means that he is maybe too hasty in claiming that mereology is, while set theory is not, ontologically innocent; for it might be possible to find set theoretic analogues of IP and IC (though see footnote 14 above).

Moreover, Lewis’s main complaint against set theory is not, contrary to appearances, its—alleged—ontological extravagance. Lewis does think that singleton-formation is a weird, strange, and controversial operation: “Singletons, and therefore all classes, are profoundly mysterious. Mysteries are an onerous burden.” (Lewis 1991, 57) The trouble with set theory is thus not, for him, that you gather many into one, but rather that you get some one ‘new’ thing out of one ‘old’ thing. This seems wrong: taking one thing twice surely does not give you two things. “But that’s the price for mathematical power. Pay it.” (Lewis 1991, 87) This complaint, however, does not so much concern ontological commitments, but a certain operation within set theory to which Lewis objects. In a similar manner, one might object to mereology by claiming that unrestricted composition is weird, strange or controversial.

If I am correct and acceptance of mereology allows one to distinguish counting objects from counting ontological commitments (given IP and IC), then Lewis’s (1991, 85) claim that one aspect of the analogy between composition and identity (i.e. weak Composition as Identity) is that they are both ontologically innocent becomes sensible. It is not that mereology is ontologically innocent *because* composition is analogous to identity—this would indeed raise the objection that the argument is either circular or the analogy too weak (circular if ontological innocence is part of the analogy; too weak since relations other than composition are also analogous to identity but evidently not ontologically innocent) (Yi 1999, 151). It is rather that mereology is ontologically innocent, and *therefore* analogous to identity, which is also ontologically innocent.

My verdict contrasts with that of Katherine Hawley (2014), who argues that neither a levelling-up nor a levelling-down account of ontological innocence suffices to render mereology innocent in comparison with mereological nihilism. The levelling-up account involves the view that there is an *implicit* commitment to fusions of the objects that you were already committed to. It fails because, to show this view to be plausible, we need to demonstrate that UMC is a necessary truth. The levelling-down account holds that the extra ontological commitments of mereology are irrelevant for theory-choice. This account is only effective when mereology is compared to restrictive accounts of composition, not when mereology is compared to nihilism. Nihilism can still be more parsimonious, since it does not accept *any* composite objects, which means that the nihilist is under no obligation to explain facts about composition—facts, of course, which defenders of UMC or restrictive accounts do have to explain.

Why does my conclusion differ from Hawley’s? I think the root difference lies in the role we ascribe to UMC. Hawley notes that if UMC is true one can deny that fusions amount to additional ontological commitments. However, she argues that this does not silence the complaint that UMC commits one to all sorts of object that one does not need to accept—given, that is, that alternative theories of composition are available:

The weak transmission thesis [i.e. the claim that composites are no further ontological commitment given the commitment to the parts] does justify the claim that, if composition is in fact unrestricted, then accepting the

truth of the unrestricted composition thesis is an ontologically innocent move: we are already committed to the myriads of composite objects. So if we have good independent reason to hold that composition is unrestricted, then we have good reason to claim that mereology is ontologically innocent, i.e. that accepting mereology merely makes explicit the vast ontological commitment we had implicitly incurred already. But this conditional fact is dialectically ineffective within the debate about composition; in particular it does not help the advocate of unrestricted composition to rebut the claim that her thesis is ontologically profligate. (Hawley 2014, 80)

I do not see why the truth of UMC matters to the question of its (lack of) ontological innocence: a false theory can still be ontologically more parsimonious than a true one. All that is needed, to rebut the claim that a theory is ontologically profligate, is to explain that *within* the theory an ontological commitment to x is necessary and sufficient for ontological commitment to the allegedly *extra* ontological commitment y . If this is the case, then y cannot be counted as an ontological commitment *next to* the ontological commitment to x .¹⁷ What I have shown is that within classical mereology commitment to an object is the same as commitment to its parts (IP), and commitment to some objects is the same as commitment to their fusion (IC). This is not to say that the entities committed to are the same *thing*. We need not, in other words, endorse Composition as Identity. Rather the claim is that within the framework of classical mereology these commitments represent one and the same ontological commitment. Hence, the defender of UMC does not need to hold that everyone is already, if implicitly, committed to UMC, or that UMC is in fact true. It need only be claimed that the acceptance of mereology entails that counting objects is not the same as counting ontological commitments, because no object would be what it is were it not for the parts it has.

So just how innocent is mereology? If by ‘ontologically innocent’ we mean that mereology can be combined with any ontology, then mereology is not innocent at all. If your ontology allows for coincident but non-identical objects, you cannot accept mereology. If your ontology has a restrictive notion of composition, you cannot accept mereology. If your ontology allows for objects to have just *one* proper part, mereology is not going to serve you well. But all this is simply to say that the principles of mereology are not ontologically redundant: mereology defines ontological possibilities and limits. These possibilities and limits are both debatable and debated. But these debates differ from disagreement over ontological parsimony, and it seems to me that the parsimoniousness of mereology is clear: both quantitatively and qualitatively, mereology is not extravagant. So, if by ‘ontologically innocent’ we mean *does not introduce additional ontological commitments*, then, yes, mereology is innocent.

4. Ontological commitments: Quinean, Goodmanian, and neo-Aristotelian

My suggestion is thus that one should adjust Quine’s criterion for ontological commitment *if* one accepts mereology. Quine advises us to read ontological commitments via the existential quantifier: the values of the bound variables are the ontological commitments of a theory. The adjustment I suggest results in what might be called a Goodmanian method of

¹⁷ All this does not mean that we cannot *compare* the ontological commitments of theories. It does mean that it is possible that for some theory T1 the commitment to x is an additional commitment *within T1* whereas in another theory T2, commitment to that same x is not an additional commitment *within T2*. To compare theories, the distinguishable constraints that a theory puts on the world are what matters. The difficulty with comparison, however, lies in the fact that ‘distinguishable’ here means ‘distinguishable *within* the own theory’.

counting ontological commitments. It says: indeed, ontological commitments are tracked by the existential quantifier, but variables that stand in mereological relations (including identity,¹⁸ but excluding, for example, disjointness) should be treated with care: the values of those variables are not each to be counted as distinct ontological commitments. Note that this method is still recognizably Quinean inasmuch as it takes the existential quantifier as its base. But it departs from Quine's ideas, since it relaxes the qualification that only identicals should not be counted twice: it says objects standing in mereological relations should not be counted twice either. This relaxation is justified given IC and IP, and it is therefore internal to classical mereology.

Let me end this section by comparing my Goodmanian method with another non-Quinean method that has recently been suggested by Jonathan Schaffer (2007). This alternative view holds that there are at least two kinds of object in the world, fundamental and derivative objects, and that these are related by a notion of ontological dependence or grounding. Ontological commitment to derivative objects is, on this view, ontologically innocent; the fundamental objects, on which derivative objects are grounded, are the true—and only—ontological costs of a theory. This neo-Aristotelian account of ontological commitment is in some ways similar to my Goodmanian one. It distinguishes counting ontological commitments from counting objects: if the singleton set {Socrates} is grounded in the existence of Socrates, one should not count the ontological commitment to {Socrates} over and above the ontological commitment to Socrates, even though they are different objects. There are also differences, however: although my account is compatible with a distinction between what is fundamental and what is derivative, it does not depend on this distinction. Moreover, the neo-Aristotelian account is far more general than the Goodmanian: it holds for every object of every kind, whereas the Goodmanian account assumes mereology and holds only for objects that stand in mereological relations. Finally, the Goodmanian account does not make existence questions trivial: whether or not there are numbers, or minds, or universals, and so forth, are all genuine questions within the Goodmanian account. Not so for the neo-Aristotelian account, according to which everything exists, but some things exist only derivatively: fictions are grounded in something non-fictional, and derivative (real) things are grounded in more fundamental entities.¹⁹

Those who are attracted to the neo-Aristotelian account might want to add my Goodmanian account to it (since they are compatible). But the two accounts are independent, and someone who thinks that existence questions are genuinely ontological but finds the arguments for IP and IC persuasive could reject the neo-Aristotelian account and continue to adopt the Goodmanian one.

5. Conclusion: The mereo-ontological free lunch

I have argued that the parts of an object are not an extra ontological commitment given ontological commitment to the object. This, I claim, is true in all mereological systems in which EP holds. Moreover, the sum of some objects is not an extra ontological commitment either, given the ontological commitment to the objects that composes that sum. This applies *only* to (general extensional) mereology ('only', since it presupposes both UMC and EP). Given these two counting policies (i.e. IP and IC), mereology is neither quantitatively nor qualitatively extravagant. This does not mean

¹⁸ Since one can define identity in terms of parthood, the suggestion here is that we should take identity as a (quasi-)mereological relation. This means mereology is seen as a theory of partial-identity, very much in line with (Armstrong 1997, 17–18).

¹⁹ For a defense of the importance of existence questions (contra the neo-Aristotelian account of ontological commitment), see (Daly and Liggins 2014).

there are no reasons to hesitate before accepting mereology: mereology bans coincident objects (which some want to have²⁰); it allows for “weird objects” (which some do not want to have²¹); it claims that there is one object that has everything else as its parts (which some people deny²²); and it takes parthood to be transitive (which some doubt it to be²³). But one should not eschew mereology because it is ontologically extravagant. It is not. You do not have to commit yourself to the parts of an object in addition to the ontological commitment to the object, just as you do not have to pay for the bread once you’ve paid for the sandwich that is partly composed of that bread. Mereology thus provides a genuine “ontological free lunch”:²⁴ once you have committed yourself to the one big universe, every fraction of that whole comes for free.

Acknowledgments

Thanks to the participants of the Higher Seminar in Philosophy at Lund University (Autumn 2014), Erik J. Olsson, Tobias Hansson Wahlberg and an anonymous referee of *Philosophical Studies* for helpful comments on earlier drafts.

References

- Armstrong, David M. 1997. *A World of States of Affairs*. Cambridge: Cambridge University Press.
- Baker, Lynne Rudder. 1997. “Why Constitution Is Not Identity.” *The Journal of Philosophy* 94 (12): 599–621.
- Baxter, Donald L. M. 1988a. “Identity in the Loose and Popular Sense.” *Mind* 97 (388): 575–82.
- . 1988b. “Many-One Identity.” *Philosophical Papers* 17 (3): 193–216.
- Berto, Francesco, and Massimiliano Carrara. 2009. “To Exist and to Count: A Note on the Minimalist View.” *dialectica* 63 (3): 343–56.
- Bohn, Einar Duenger. 2014a. “Unrestricted Composition as Identity.” In *Composition as Identity*, edited by Donald L. M. Baxter and Aaron J. Cotnoir, 143–65. Oxford and New York: Oxford University Press.
- . 2014b. “From Hume’s Dictum Via Submergence to Composition as Identity or Mereological Nihilism.” *Pacific Philosophical Quarterly* 95 (3): 336–255. doi:10.1111/papq.12034.
- Cotnoir, Aaron J. 2014. “Composition as Identity - Framing the Debate.” In *Composition as Identity*, edited by Donald L. M. Baxter and Aaron J. Cotnoir, 3–23. Oxford and New York: Oxford University Press.
- Daly, Chris, and David Liggins. 2014. “In Defence of Existence Questions.” *The Monist* 97 (4): 460–78.
- Fine, Kit. 2003. “The Non-Identity of a Material Thing and Its Matter.” *Mind* 112 (446): 195–234. doi:10.1093/mind/112.446.195.
- Hawley, Katherine. 2014. “Ontological Innocence.” In *Composition as Identity*, edited by Donald L. M. Baxter and Aaron J. Cotnoir, 70–89. Oxford and New York: Oxford University Press.
- Hovda, P. 2009. “What Is Classical Mereology?” *Journal of Philosophical Logic* 38 (1): 55–82. doi:10.1007/s10992-008-9092-4.
- Johansson, Ingvar. 2004. “On the Transitivity of Parthood Relations.” In *Relations and Predicates*, edited by Herbert Hochberg and Kevin Mulligan, 161–81. Frankfurt: Ontos Verlag.
- Johnston, Mark. 1992. “Constitution Is Not Identity.” *Mind* 101: 89–105.
- Koslicki, Kathrin. 2004. “Constitution and Similarity.” *Philosophical Studies* 117: 327–64.
- Lewis, David. 1991. *Parts of Classes*. Oxford: Wiley-Blackwell.
- Lowe, E. J. 1995. “Coinciding Objects: In Defense of the ‘Standard Account.’” *Analysis* 55: 171–78.

²⁰ Arguments for coincident non-identical objects that stand in a relation of constitution (i.e. “The Standard View”) can be found in Baker (1997); Fine (2003); Johnston (1992); Koslicki (2004); Lowe (1995); Simons (1987, 210–252); and Thomson (1998).

²¹ For a defense of restricted composition under which there are few weird objects, see (Markosian 1998; 2008).

²² For example, Simons (2003).

²³ Most explicitly, Rescher (1955). (Cf. Johansson (2004), who objects to the idea that all parthood predicates pick out transitive parthood relations, insisting that some might pick out three-place parthood relations that fail to be transitive.)

²⁴ This expression comes from Armstrong (1997, 12), but note that for Armstrong the ticket to the free-lunch is supervenience: what supervenes is—usually—ontologically innocent. For mereology, no such thing is needed: IP and IC are silent about supervenience.

- . 2006. *The Four-Category Ontology: A Metaphysical Foundation for Natural Science*. Oxford: Oxford University Press.
- Markosian, N. 1998. "Brutal Composition." *Philosophical Studies* 98: 211–49.
- . 2008. "Restricted Composition." In *Contemporary Debates in Metaphysics*, edited by T. Sider, J. Hawthorne, and D. Zimmerman, 341–63. Oxford: Blackwell.
- Quine, Willard V.O. 1948. "On What There Is." *The Review of Metaphysics* 2 (5): 21–38.
- Rayo, Agustin. 2007. "Ontological Commitment." *Philosophy Compass* 2 (3): 428–44.
- Rescher, Nicholas. 1955. "Axioms for the Part Relation." *Philosophical Studies* 6: 8–11.
- Schaffer, Jonathan. 2007. "From Nihilism to Monism." *Australasian Journal of Philosophy* 85 (2): 175–91.
- . 2010. "Monism: The Priority of the Whole." *Philosophical Review* 119 (1): 31–76.
- Simons, Peter. 1987. *Parts. A Study in Ontology*. Oxford: Clarendon.
- . 2003. "The Universe." *Ratio* XVI: 236–50.
- Thomson, Judith Jarvis. 1998. "The Statue and the Clay." *Nous* 32: 148–73.
- Van Inwagen, Peter. 2002. "The Number of Things." *Philosophical Issues* 12: 176–96.
- Varzi, Achille C. 2000. "Mereological Commitments." *dialectica* 54 (4): 283–305.
- . 2008. "The Extensionality of Parthood and Composition." *The Philosophical Quarterly* 58 (230): 108–33.
- . 2014. "Counting and Countenancing." In *Composition as Identity*, edited by Donald L. M. Baxter and Aaron J. Cotnoir, 47–69. Oxford and New York: Oxford University Press.
- . 2015. "Mereology." Edited by Edward N. Zalta. *Stanford Encyclopedia of Philosophy*.
<http://plato.stanford.edu/archives/spr2015/entries/mereology/>.
- Wallace, Megan. 2011a. "Composition as Identity: Part I." *Philosophy Compass* 6 (11): 804–16.
- . 2011b. "Composition as Identity: Part II." *Philosophy Compass* 6 (11): 817–27.
- . 2014. "Composition as Identity, Mereological Essentialism, and Modal Parts." In *Composition as Identity*, edited by Donald L. M. Baxter and Aaron J. Cotnoir, 111–29. Oxford and New York: Oxford University Press.
- Yi, Byeong-Uk. 1999. "Is Mereology Ontologically Innocent?" *Philosophical Studies* 93 (2): 141–60.