Nothing over and above*

Theodore Sider

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"The whole is nothing over and above the parts"—this slogan animates many theories of parthood, is intuitively compelling, and is arguably central to our ordinary conception. Yet it seems to make no sense. As I understand it, the slogan says that an exceedingly intimate relationship holds between a whole and its parts: in some sense the whole is *no different from* its parts. But how can that be? I am just one thing; my head, arms, legs, and torso are more than one in number; so how can I be "nothing over and above" or "no different from" them?

The slogan is admittedly vague. But there are various precise theses purporting to capture the slogan's spirit whose truth we can meaningfully debate. The murky question of whether the theses really capture the spirit will remain—and I do not mean to downplay the importance of this question—but at least the murk will be contained. First we will consider a boring (though perhaps ultimately the best) precise rendering of the slogan's spirit, which is simply that classical mereology is true. We'll then discuss some more exciting ways to precisify the slogan, and conclude by asking whether the exciting ways promise anything better.

'Nothing over and above' is a flexible piece of philosophical rhetoric, applicable across a variety of situations and to entities of various categories. A fact might be said to be nothing over and above another when it is necessitated or grounded by the latter fact; a property might be said to be nothing over and above another when it is realized by the latter property; one might say that wholes are qualitatively nothing over and above their parts meaning that composite objects possess no "emergent" properties; and so on.[1] But the slogan to be explored here concerns, it would seem, a narrower sense of 'nothing over and above': that of a certain especially intimate ontic relation between a thing

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[1]The broad sense may be akin to Karen Bennett's notion of building. Bennett also provides an interesting way to take the slogan, albeit one that is very distant from those considered here: positing nonfundamental entities does not count against the simplicity of a theory (2015, chapter 7).

and its parts. Though I will be open to attempts to explicate this narrower sense in terms of other sorts of "nothing over and above", the narrower sense itself is our target.

1. Classical mereology

Classical mereology is a formal theory of parts and wholes.[2] A typical presentation: take '$x < y$' as a primitive predicate for parthood, define overlap ("Oxy") as sharing a part in common, discreteness ("Dxy") as nonoverlap, proper parthood ("$x \ll y$") as parthood without identity, and fusion as follows:[3]

$x \,\mathrm{Fu}\, S$ ("x is a fusion of set S") $=_{\mathrm{df}}$ each member of S is part of x, and each part of x overlaps some member of S

As axioms, assume that $<$ is reflexive, transitive, antisymmetric, and also obeys:[4]

Weak supplementation If $x \ll y$, then some part of y is discrete from x

Unrestricted composition For any nonempty S there exists a fusion of S

One way to precisify our slogan would be to say that each theorem of classical mereology—or perhaps, each theorem in a certain chosen subsystem of classical mereology—is true. Why would this count as a precisification of the slogan, a way of capturing the vague idea that the whole is nothing over and above the parts? Because, as we will see, one can think of the axioms of classical mereology—some of them, anyway, and perhaps all—as being in some sense underwritten by the slogan, much as (some of) the axioms of Zermelo-Frankel set theory are often regarded as being underwritten by the intuitive iterative conception of set.[5]

Showing axioms in a formal system to be "underwritten" by a vague slogan is an inherently nonrigorous process, but part of the process can be made rigorous. The *non*rigorous part is a phase of "regimentation", in which we regiment the concept of "nothing over and above", lay down precise principles on how

[2] See Hovda (2009); Simons (1987).

[3] When $x \,\mathrm{Fu}\{y_1 \ldots\}$ we may say informally that x is a fusion of $y_1 \ldots$.

[4] This axiom set is not minimal: reflexivity and antisymmetry can, for instance, be eliminated (Hovda, 2009). Since we will be interested in certain subsystems of classical mereology, it's best to retain the redundancy.

[5] Thanks to Jonathan Schaffer for this analogy.

the regimentation behaves that seem to be inspired by its intended—though unclear and perhaps incoherent!—content, and precisely formulate the slogan based on the regimentation. This phase is nonrigorous because there can be no formal proof that the laid-down principles and precise formulation are faithful to the intended intuitive content of "nothing over and above" and the slogan. (Compare the relationship between the informal notion of computability and its various formalizations.) But once this is done, the remaining "derivation" phase is perfectly rigorous: we can derive axioms of mereology from the regimented slogan plus the laid-down principles. (Compare what Boolos (1971) did for the iterative conception of set.) I will show how to do this for the axioms of reflexivity, transitivity, antisymmetry, and weak supplementation.[6] (We will discuss unrestricted composition in section 4.)

Let's begin with the regimentation phase. First we regiment 'nothing over and above' as a two place predicate $\approx$:[7]

$x \approx S$ "object x is nothing over and above the members of set S"

Next we lay down these principles governing $\approx$:

$\approx$-Reflexivity $x \approx \{x\}$

Cut If $x \approx S \cup \{y\}$ and $y \approx T$ then $x \approx S \cup T$

$\approx$-Uniqueness if $x \approx S$ and $y \approx S$ then $x = y$

These are natural assumptions. For instance, Cut tells us that if the army is nothing over and above the soldiers, and if each soldier is nothing over and above her molecules, then the army is nothing over and above all the molecules of all its soldiers; and $\approx$-Uniqueness tells us that a statue and a lump of clay cannot both be nothing over and above—no different from—the very same molecules. Finally, we formulate the slogan based on the regimentation:

Slogan For any object x and set S, $x \,\mathrm{Fu}\, S$ if and only if $x \approx S$

Note three features of this formulation. First, we have not restricted the slogan to certain privileged decompositions of wholes (such as to proper parts or to

[6] The arguments are analogous to those in Sider (2007, 3.2); see also Sider (2007, 4.2) and Lewis (1991, 3.6)).

[7] Though $\approx$ is a relation to sets, nothing-over-and-above is not. The intended gloss of "$x \approx \{y_1 \dots\}$" is "x is nothing over and above $y_1, \dots$", not "x is nothing over and above $\{y_1, \dots\}$".

atoms); we have interpreted it as saying that for *each* decomposition of the whole, the whole is nothing over and above the members of that decomposition.[8] Second, we have interpreted "whole" in the slogan as fusion in the sense of Fu. And third, we have interpreted the slogan "biconditionally": as not merely implying that if $x \,\mathrm{Fu}\, S$ then $x \approx S$, but as also implying the converse.[9] "Nothing over and above" must be understood as in the beginning of the paper if the converse is to be plausible.[10] There I gave the alternate gloss: "no different from", which implies "no less than" as well as "no more than". Thus, where $x_1, x_2 \ldots$ are all my subatomic particles, a mere proper part of me such as my hand does *not* count as being nothing over and above $x_1, x_2 \ldots$ in the present sense.

Now for the derivation phase: reflexivity, transitivity, antisymmetry, and weak supplementation follow from the regimented slogan and the principles governing $\approx$:

Reflexivity: for any object x, by $\approx$-Reflexivity, $x \approx \{x\}$; by the slogan, $x \,\mathrm{Fu}\{x\}$; by the definition of Fu, $x < x$.

Transitivity: reflexivity (which was just derived from the slogan) and the definition of Fu imply:

(+) if $a < b$ then $b \,\mathrm{Fu}\{a, b\}$

So now, assume $x < y$ and $y < z$. By (+), $y \,\mathrm{Fu}\{x, y\}$ and $z \,\mathrm{Fu}\{y, z\}$; by the slogan, $y \approx \{x, y\}$ and $z \approx \{y, z\}$; by Cut, $z \approx \{x, y, z\}$; by the slogan, $z \,\mathrm{Fu}\{x, y, z\}$; by the definition of Fu, $x < z$.

$\approx$-Uniqueness plus the slogan imply the principle of uniqueness of fusions:

Uniqueness if $x \,\mathrm{Fu}\, S$ and $y \,\mathrm{Fu}\, S$ then $x = y$

(Uniqueness is perhaps most clearly underwritten by the slogan of all the principles of mereology.) Uniqueness, (+), and reflexivity then imply the remaining two axioms:

Antisymmetry: if $x < y$ and $y < x$ then by (+), $x \,\mathrm{Fu}\{x, y\}$ and $y \,\mathrm{Fu}\{x, y\}$, and so by uniqueness, $x = y$.

Weak supplementation: suppose for reductio that i) $x < y$, ii) $x \neq y$, and iii) each part of y overlaps x. Given i) and iii), by the definition of Fu, $y \,\mathrm{Fu}\{x\}$.

[8] Thus in particular we have not interpreted the slogan as saying (merely) that the whole is nothing over and above the collection consisting of *all* its parts.

[9] Compare the distinction between "strong" and "superstrong" composition as identity in Sider (2007).

[10] Likewise for $\approx$-Uniqueness.

Given reflexivity and the definition of Fu, $x\,\mathrm{Fu}\{x\}$; so by uniqueness, $x = y$, which contradicts ii).

There is a sense, then, in which the slogan that the whole is nothing over and above the parts underwrites reflexivity, transitivity, antisymmetry, and weak supplementation. But there is a wrinkle: my derivations of the axioms from the regimented slogan are sensitive to certain details of my chosen formulation of mereology.

For example, my chosen notion of fusion was Fu; but other formulations of classical mereology sometimes use other notions of fusion, such as:[11]

$x\,\mathrm{Fu}^*\,S =_{\mathrm{df}}$ for all y, y overlaps x iff y overlaps at least one member of S

$x\,\mathrm{Fu}^{\mathrm{lub}}\,S =_{\mathrm{df}}$ each member of S is part of x and x is part of everything that contains each member of S as part (i.e., x is a least upper bound of S)

This raises a concern. As I mentioned earlier, I formulated the slogan as concerning fusion *in the* Fu *sense of 'fusion'*. Accordingly, when drawing out consequences of the slogan, I made use of the definition of Fu. But suppose the slogan were instead understood in the sense of Fu^* or $\mathrm{Fu}^{\mathrm{lub}}$ (that is, as saying that $x\,\mathrm{Fu}^*\,S$ iff $x \approx S$, or that $x\,\mathrm{Fu}^{\mathrm{lub}}\,S$ iff $x \approx S$). In that case the slogan's implications would not concern fusion in the Fu sense, and my arguments would not immediately apply. At best, analogous arguments, appealing to the definition of the replacement notion of fusion, could be constructed.

In many contexts it does not matter which of the three notions of fusion one uses, since given the entirety of classical mereology the three notions are equivalent.[12] But in the present context we are trying to *justify* classical mereology (by deriving certain axioms from the slogan), so the equivalence of the three notions cannot simply be assumed. There is, therefore, a question of whether one can still argue from the slogan to the axioms when one interprets the slogan in the sense of Fu^* or $\mathrm{Fu}^{\mathrm{lub}}$.

The crucial move in my argument for reflexivity was from $x\,\mathrm{Fu}\{x\}$ to $x < x$; this was justified because the definition of Fu logically implies that each member of S is part of any Fu-fusion of S. Since the definition of $\mathrm{Fu}^{\mathrm{lub}}$ shares this feature—it logically implies that each member of S is part of any $\mathrm{Fu}^{\mathrm{lub}}$-fusion of S—the argument for reflexivity still goes through if the slogan is interpreted using $\mathrm{Fu}^{\mathrm{lub}}$. But the definition of Fu^* does not on its own logically imply that

[11] See Simons (1987, p. 35).

[12] See Hovda (2009); the axiomatization differs depending on the chosen notion of fusion.

members of S are parts of any Fu*-fusion of S (and there is no other available justification of the crucial move in the argument for reflexivity). The claim that $x\,\mathrm{Fu}^*\,S$ says merely that for all z, z overlaps x iff z overlaps some member of S. To be sure, this does imply, *given further principles from classical mereology*, that each member of S is part of x; but in the present context those further principles would need first to be derived from the slogan, and I see no way to do that.

The situation with transitivity and antisymmetry is parallel. The arguments for those axioms relied on principle (+), which is a logical consequence of the definition of Fu and reflexivity. The corresponding principle for Fu$^{\text{lub}}$ is also a logical consequence of the definition of Fu$^{\text{lub}}$ plus reflexivity; but the corresponding principle for Fu* does not follow from the definition of Fu* without the use of further principles of classical mereology.

Thus the case for reflexivity, transitivity, and antisymmetry on the basis of the slogan requires that the slogan be true either in the sense of Fu or Fu$^{\text{lub}}$ (or both). (Let us set aside the possibility of taking the slogan in the sense of some fourth notion of fusion.) The case would fail if the slogan were true *only* in the sense of Fu*. Now, it may be argued that Fu* is not an intuitive notion of fusion, precisely because its definition does not guarantee that a fusion of some things must contain those things as parts. If this is right, then assuming that the slogan expresses an intuitive insight into the nature of composition and parthood, one would expect it to be true under some natural, intuitive notion of fusion, and hence under either Fu or Fu$^{\text{lub}}$ (or both), in which case the derivations of reflexivity, transitivity, and antisymmetry go through. The case for those three axioms, then, arguably remains robust.

The status of weak supplementation, though, is less clear. Fu$^{\text{lub}}$ is surely a reasonable notion of fusion; and the argument from the slogan to weak supplementation apparently fails if the slogan is understood in terms of Fu$^{\text{lub}}$. The argument began by deriving the uniqueness of fusions from the slogan, and then derived weak supplementation from uniqueness of fusions. But if the slogan concerns Fu$^{\text{lub}}$ then the first stage delivers merely uniqueness of fusions in the sense of Fu$^{\text{lub}}$, which does not imply weak supplementation.[13]

[13] In a model containing just two things, an object b and a single proper part, a, of b (each of which is part of itself), weak supplementation fails while uniqueness in the Fu$^{\text{lub}}$ sense holds (as do reflexivity, transitivity, and antisymmetry). The crucial thing is that although both b and a count as Fu-fusions of $\{a\}$, b is not a *least* upper bound of $\{a\}$ since it's not part of a, which is an upper bound of $\{a\}$. (Compare Hovda's (2009, p. 67) remark that the point of weak supplementation is to insure that Fu-fusions are least upper bounds.)

The slogan, then, implies weak supplementation under one natural notion of fusion but not under another such notion. So does the slogan underwrite the axiom? Should a friend of the slogan accept it under both readings, or just one; and if the latter, which one? Perhaps the slogan is too unclear to deliver a verdict.

A related problem concerns different choices of primitive notions. I said above that my arguments from the slogan to reflexivity, transitivity, and antisymmetry do not go through when the slogan is understood in terms of Fu^*. However, that was under the assumption that $<$ is an undefined notion. Classical mereology is sometimes formulated with overlap as the primitive notion, and with "$x < y$" defined as "$\forall z(zOx \to zOy)$". Reflexivity and transitivity of parthood are logical consequences of this definition, and so one might regard them as not needing justification by the slogan.[14] Moreover, the slogan, understood in terms of Fu^*, now implies antisymmetry.[15] Of course, once we shift from $<$ to O as the primitive notion of mereology, new axioms are needed, and their justification from the slogan will need to be considered in turn. The point is just that, as before, the amount of classical mereology implied by the slogan depends on how exactly we understand the notion of whole—that is, fusion—in the slogan. As we saw before, it matters how fusion is to be defined in terms of parthood, and we now see that it also matters, even given a fixed definition of fusion in terms of parthood, whether parthood is to be primitive or defined.

This section has been a little disappointing. My derivation of axioms of mereology was distressingly sensitive to subtle matters of how the slogan is to be formalized (particularly in the case of weak supplementation). Moreover, even setting this concern aside, my formalization of the slogan might be regarded as stretching the slogan's spirit. It would be nicer to find a precise thesis that is clearly in the spirit of the slogan, and from which classical mereology, or a good portion of it anyway, could be robustly derived.

[14]In this section I have been assuming that definitions, such as the definition of Fu in terms of $<$, do not need to be justified by the slogan; this, though, might be questioned.

[15]If $x < y$ and $y < x$ then by the definition of $<$, $\forall z(zOx \leftrightarrow zOy)$. This implies $\forall z(zOx \leftrightarrow (zOx \vee zOy))$, so we have $x\,\mathrm{Fu}^*\{x,y\}$. Similarly, we have $y\,\mathrm{Fu}^*\{x,y\}$. So by uniqueness of Fu^*-fusions (which is justified by the slogan, now interpreted using Fu^*), $x = y$.

2. Fine on mere sums

Kit Fine's fascinating article "Towards a theory of part" introduces a precise sense in which the composite objects of classical mereology are nothing over and above their parts, or are "mere sums", as he puts it. Let us examine this idea, and its relation to the unresolved issues of the previous section.

The main point of Fine's article is to defend two claims about parthood: *pluralism* and *operationalism*. According to pluralism, there are many different kinds of parthood relations. Each of the following relations is a kind or species of parthood, according to Fine: the relation of parthood in classical mereology, the relation of membership in set theory, the relation between sequences and their members, and the relation between propositions and their constituents.[16]

According to operationalism, relations of parthood are to be defined in terms of operations of composition, rather than the other way around. An operation is like a function: it yields an output if you give it inputs. Grammatically, expressions for operations combine with terms to form terms. So, to take an arithmetic example, the terms '2' and '3' combine with the operation expression '$\times$' to yield the term '2×3'; similarly, '1' and '2×3' combine with the operation expression '$+$' to yield the term '$1+(2\times 3)$'. If Σ is an operation of composition taking operands $y_1, y_2, \ldots$ to the object x that they compose, we may write: $x = \Sigma(y_1, y_2, \ldots)$. A composition operation is an operation whereby wholes are generated out of parts. Given an operation Σ of composition, an associated relation of parthood may be defined. First we define the operation's associated relation of constituency, or "direct parthood":

Constituent x is a constituent of $y =_{\text{df}} y$ is the result of applying Σ to x, perhaps together with some other objects (i.e., $y = \Sigma(\ldots x \ldots)$)

Parthood may then be defined as the ancestral of constituency:

Parthood $x < y =_{\text{df}} x$ is a constituent of y, or a constituent of a constituent of y, or…

Thus Fine reverses the usual order of definition in classical mereology, in which a predicate for parthood ($<$) is taken as primitive and then is used to define an operation of composition (fusion).

[16] In each of the latter three cases it is really the ancestral of the relation in question that is a species of parthood. On mereological pluralism see also McDaniel (2004, 2009).

Given Fine's operationalism, his pluralism is in the first instance a pluralism about composition operations. (This then induces pluralism about parthood relations.) Composition operations for Fine include an operation of mereological summation ("Σ" henceforth), the "set-builder" operation, the "sequence-builder" operation, and so forth.[17]

Now, Fine does not accept the nothing-over-and-above slogan for all forms of composition, but he does accept it for mereological summation:

> There are two aspects of the notion of whole that have often been implicit in the recent development of mereology. The first, more formal aspect is that a whole is a 'mere sum'. It is nothing over and above its parts—or perhaps we should say, more cautiously, that it is nothing over and above its parts except insofar as it is one object rather than many. (2010, p. 572)

He then goes on to articulate the idea that mere sums are "nothing over and above" their parts in terms of a constraint on Σ:

Summative identity: Any regular identity condition is true

where an identity condition is a formula of the form '$s = t$', where s and t are terms in Σ, a term in Σ is any term constructed solely from variables and Σ, a formula '$s = t$' is regular iff the same variables occur in s and t, and a formula is true iff it is true for all values of its free variables. So, for instance, $\Sigma(x, \Sigma(y, z)) = \Sigma(y, \Sigma(x, z))$ is regular, and so is true for all values of its variables.

Fine goes on to derive the condition of summative identity from some more basic constraints on Σ:

Absorption: $\Sigma(\ldots, x, x, \ldots, \ldots, y, y, \ldots, \ldots) = \Sigma(\ldots, x, \ldots, y, \ldots)$

Collapse: $\Sigma(x) = x$

Leveling: $\Sigma(\ldots, \Sigma(x, y, z, \ldots), \ldots, \Sigma(u, v, w, \ldots), \ldots) = \Sigma(\ldots, x, y, z, \ldots, \ldots, u, v, w, \ldots, \ldots)$

Permutation: $\Sigma(x, y, z, \ldots) = \Sigma(y, z, x, \ldots)$ (and similarly for all other permutations)

[17] Compare Karen Bennett's (2011; 2015) pluralism about "building relations".

Since each of these four constraints is a regular identity condition, each follows from summative identity. Thus summative identity is equivalent to the four taken together.

Now, Fine says that absorption, collapse, leveling, and permutation "constitute an analysis of the notion of mere sum" (p. 574); and he says that:

> [Summative identity] gives formal expression to the idea that wholes built up from the same parts should be the same, and this is something that appears to be constitutive of our intuitive conception of a mere sum as nothing over and above its parts.... Thus philosophical reflection on the notion of mere sum is able to provide us with a simple and natural characterization of classical mereology. (pp. 572–3)

So it is natural to wonder whether summative identity gives us what we are after in this paper: a precise thesis capturing the slogan. And it is also natural to wonder how much of classical mereology is implied by summative identity.

Summative identity does indeed seem to be underwritten by the slogan. Not only is this the case on an intuitive level, summative identity is implied (modulo the existence of Σ-composites) by an appropriate regimentation of the slogan in terms of Σ, plus the assumptions about $\approx$ laid down in the previous section.[18] (This is unsurprising given the close correspondence of Cut to Leveling, $\approx$-reflexivity to Collapse, and the set-theoretic regimentation of $\approx$ to Absorption and Permutation.) Moreover, there is no puzzle like that at the end of the previous section of which notion of fusion is to be used in interpreting

[18] Begin by using Σ as a predicate rather than a term-forming operator: let $x\Sigma(y_1\dots)$ mean that x is *a* Σ-sum of $y_1,\dots$, with no assumption of uniqueness. Assume an infinitary language allowing infinite lists of variables (and other terms) of arbitrarily high cardinality. Take the slogan as the schema "$x\Sigma(y_1\dots)$ if and only if $x \approx \{y_1\dots\}$". Uniqueness of Σ-sums then follows from the slogan and $\approx$-uniqueness. So we may henceforth use Σ as a term-forming operator (modulo the assumption of unrestricted Σ-composition, which we here simply assume), and reformulate the slogan thus: $\Sigma(y_1\dots) \approx \{y_1\dots\}$. Now for Fine's four principles. Absorption: by the slogan, $\Sigma(A,x,x,B,y,y,C) \approx \{A,x,x,B,y,y,C\}$ and $\Sigma(A,x,B,y,C) \approx \{A,x,B,y,C\}$; but $\{A,x,x,B,y,y,C\} = \{A,x,B,y,C\}$, and so by $\approx$-uniqueness, $\Sigma(A,x,x,B,y,y,C) = \Sigma(A,x,B,y,C)$. (Uppercase variables $A,B,\dots$ are schematic for arbitrary lists of terms.) Permutation is similar. Collapse: by the slogan, $\Sigma(x) \approx \{x\}$; by $\approx$-reflexivity, $x \approx \{x\}$; by $\approx$-uniqueness, $\Sigma(x) = x$. Leveling: we'll establish $\Sigma(A,\Sigma(B),C) = \Sigma(A,B,C)$ (the proof of the general case, i.e leveling multiple Σ terms simultaneously, is parallel). Given absorption and permutation, it suffices to establish $\Sigma(A,\Sigma(B)) = \Sigma(A,B)$. By the slogan, $\Sigma(A,\Sigma(B)) \approx \{A,\Sigma(B)\}$ and $\Sigma(B) \approx \{B\}$; by cut, $\Sigma(A,\Sigma(B)) \approx \{A,B\}$; by the slogan, $\Sigma(A,B) \approx \{A,B\}$; by $\approx$-Uniqueness, $\Sigma(A,\Sigma(B)) = \Sigma(A,B)$.

the slogan: it's natural for an operationalist to insist on taking the slogan as concerning Σ.

But it is less clear whether summative identity captures the entirety of the slogan. First note that it does not imply all of classical mereology (not that Fine says it does). It does imply reflexivity, transitivity, and antisymmetry.[19] But it does not imply weak supplementation.[20] Consider a model whose domain is the nonempty intervals of real numbers (closed or open on either side) drawn from $[0,1]$, plus nonempty unions of such intervals, and interpret Σ as union. Thus understood Σ is always defined, since a union of unions of intervals is itself a union of intervals. Absorption, collapse, leveling, and permutation all hold. Now consider: $(0,1]$ is part of $[0,1]$ in this model. ($(0,1]\cup[0,1]=[0,1]$; thus $\Sigma((0,1],[0,1])=[0,1]$.) But $(0,1]\neq[0,1]$. Thus $(0,1]\ll[0,1]$. But any part of $[0,1]$ overlaps $(0,1]$. (Let x be part of $[0,1]$, i.e., $[0,1]=x\cup\ldots$. Since x is in our domain, it contains some interval i from $[0,1]$ as a (perhaps improper) subset. Divide i into thirds: $i=i^l\cup i^m\cup i^r$, so that i^m contains neither 0 nor 1.

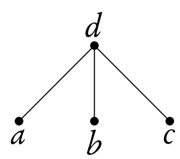
[19]Reflexivity follows from Collapse. Transitivity follows directly from Fine's general definition of parthood in terms of composition, without any special assumptions involving Σ. However, Fine points out that a more substantive question is whether the relation of being a component is transitive; and given Leveling, it is. (Suppose x is a component of y and y is a component of z. Then $y=\Sigma(A,x)$ and $z=\Sigma(B,y)$, for some A and B; whence $z=\Sigma(B,\Sigma(A,x))$, which by leveling is $\Sigma(B,A,x)$, so x is a component of z.) To establish antisymmetry, let $x<y$ and $y<x$. Then (a) $y=\Sigma(A,x)$ and (b) $x=\Sigma(B,y)$, for some A and B. Substituting (b) into (a) we have $y=\Sigma(A,\Sigma(B,y))$, which by Leveling is $\Sigma(A,B,y)$. Substituting that into (b) yields $x=\Sigma(B,\Sigma(A,B,y))$, which by leveling, permutation, and absorption is $\Sigma(A,B,y)$, i.e. y.

[20]What about unrestricted composition? Here we must distinguish between unrestricted composition in the Σ sense—i.e., the principle that $\Sigma(x_1\ldots)$ exists whenever $x_1\ldots$ do, and unrestricted composition in the sense of 'fusion', when 'fusion' is defined in terms of parthood (which in turn is defined in terms of Σ). As for the former, Fine uses Σ as a term-forming operator and does not provide for empty terms in the background logic, and so simply presupposes that Σ composites exist; but of course, as he points out (note 11), one could relax this presupposition. As for the latter, even given unrestricted composition in the Σ sense, unrestricted composition in the Fu sense doesn't follow, as can be seen in the four-element model given in the text: a and b don't have an Fu-fusion since the only object containing a and b as parts is d, but d has a part that doesn't overlap either a or b, namely, c (compare Simons (1987, p. 32)). The counterexample also goes through under Fu*, but unrestricted composition in the Fu$^{\text{lub}}$ sense follows from Fine's principles (and unrestricted Σ-composition) since $\Sigma(x_1\ldots)$ counts as a least-upper-bound fusion of $x_1\ldots$. (Obviously each x_i is part of $\Sigma(x_1\ldots)$. Next suppose that each x_i is part of some y. Then by the definition of 'part' in terms of Σ, (*) $y=\Sigma(x_1,B_1)=\Sigma(x_2,B_2)=\ldots$. But since by absorption and collapse, $y=\Sigma(y,y,\ldots)$, (*) yields $y=\Sigma(\Sigma(x_1,B_1),\Sigma(x_2,B_2),\ldots)$; then by leveling and permutation, $y=\Sigma(\Sigma(x_1,x_2\ldots),B_1,B_2\ldots)$; and so we have $\Sigma(x_1,x_2\ldots)<y$.)

i^m is part of both x and $(0,1]$.)[21]

Does the fact that Fine's principles don't imply weak supplementation show that they do not *fully* capture "nothing over and above"? I don't think so: weak supplementation bears an unclear relationship to that slogan. Furthermore, the only argument from the slogan to weak supplementation considered in the previous section ran through the uniqueness of fusions. But an operationalist could insist on interpreting the slogan only in terms of Σ. Thus understood it delivers only uniqueness of Σ-fusions, which does not imply weak supplementation (in the countermodel to weak supplementation, uniqueness of Σ-fusions is true). So far, then, the hypothesis that Fine's principles fully capture the slogan remains standing.

However, the following model seems, at first glance anyway, to show that Fine's principles do not, after all, fully articulate "nothing over and above", and that they do not "constitute an analysis of the notion of mere sum":



$$\Sigma(a,b) = \Sigma(b,c) = \Sigma(a,c) = \Sigma(a,b,c)$$

Fine's four principles are satisfied in this model. But how can a single object, d, be nothing over and above, or a mere sum of, a and b, while also being nothing over and above, or a mere sum of, b and c?

There is a complication, though. In a discussion of certain other composition operations (which obey principles other than summative identity), Fine says that "the only identities that should hold are the ones that can be shown to hold on the basis of the defining principles" , and he continues in a footnote: "To put it algebraically, the intended model for the principles should be isomorphic to a 'word algebra' over the 'generators' or given elements" (p. 575).[22] Now, Fine does not mention this further claim in his discussion of mere sums. Nevertheless, one possible view would be that the analysis of mere sum should include this further claim, and not merely the four principles. This would rule out my four-element model, since that model makes identifications (such as $\Sigma(a,b) = \Sigma(b,c)$) that cannot be shown to hold on the basis of Fine's

[21]Note that in this model, both $(0,1]$ and $[0,1]$ are fusions in the 'Fu' sense of $(0,0.5), [0.5,1]$, so uniqueness fails.

[22]The algebraic clarification of the view is needed; otherwise one might object: "let 'e' and 'f' name the same thing; '$e = f$' is then true but does not follow from the defining principles".

four principles (better: my model is not isomorphic to the appropriate word algebra over a, b, and c). Now, it is unclear how this view will work in general, since talk of generators will need to be explained in the case of gunk; but in any case it is certainly worthy of further exploration.

Let me close my discussion of Fine with a tangential point. Fine gives powerful arguments in favor of the operational approach, but here is a consideration that cuts the other way. In the operationalist approach to set theory (similar remarks apply in other cases), in which a set-builder operation Σ_{set} replaces $\in$ as the primitive notion, logical ideology beyond that of first-order logic will be needed to formalize expressions "$\Sigma_{\text{set}}(x_1, x_2, \dots)$" with infinitely many operands. Such resources are unneeded in familiar first-order set theories in which $\in$ is the primitive notion. Of course, there are arguments—such as in Boolos (1984)—that first-order set theories are inferior to set theories formulated using stronger resources, such as plural quantification. But the operationalist's need for non-first-order resources is deeper: without them, the operationalist cannot even formulate the most basic claims about infinite sets. Moreover, the operationalist needs more powerful resources: the language must allow Σ expressions with lists of operands of arbitrarily high cardinality. If set theory is intended as a fundamental theory, the complexity of the associated logical ideology may well be significant.

3. Composition as identity

Let us turn next to a rather exciting—in both a good way and a bad way—attempt to articulate our slogan, namely, "composition as identity". On this view, the intimate "nothing over and above" relation between a thing and its parts is just identity. Here are Megan Wallace and Donald Baxter in favor of this idea:

> If the chair is distinct from the seat and the leg, then we are committed to co-located objects. The chair is a material object that occupies region, R. The seat and the leg are material objects that occupy region, R. This is…complete spatial overlap: there is no place that the chair is that the seat and leg are not, and there is no place that the seat and the leg are that the chair is not. Since complete spatial co-location is unwelcome, then perhaps the seat and the leg are *not* distinct from the chair. (Wallace, 2011, p. 804)
>
> Suppose a man owned some land which he divides into six parcels. Over-

come with enthusiasm for the Non-Identity view he might try to perpetrate the following scam. He sells off the six parcels while retaining ownership of the whole. That way he gets some cash while hanging on to his land. Suppose the six buyers of the parcels argue that they jointly own the whole and the original owner now owns nothing. Their argument seems right. But it suggests that the whole was not a seventh thing. (Baxter, 1988*a*, p. 579)

The doctrine of composition as identity that I will consider does not say that for each part, the whole is identical to that part.[23] It says, rather, that the whole is identical to the parts *taken together*. To state the view more precisely, we employ irreducibly plural quantification (Boolos, 1984). First redefine Fu in plural rather than set-theoretic terms:

$$x\,\mathrm{Fu}\,Y =_{\mathrm{df}} \forall z(Yz \rightarrow z < x) \wedge \forall z(z < x \rightarrow \exists w(Yw \wedge Ozw))$$

("anything that is one of the Ys is part of x, and each part of x overlaps something that is one of the Ys") and then state the doctrine as follows:

Composition as identity If $x\,\mathrm{Fu}\,Y$ then $x = Y$

On this view, the identity predicate, '='—which expresses the one and only sort of identity—can take either plural or singular arguments on either side. Identity can hold one-many, and does so in the case of a composite and its many parts.

We began by noting the apparent incoherence of the slogan. We asked, rhetorically, how can I be nothing over and above my parts when they are many and I am one? Articulating the slogan as classical mereology avoided incoherence by reducing the slogan's role to a mere spirit or picture guiding the classical mereologist's choice of axioms; nothing directly corresponding to the slogan appears in the official theory. Similar remarks apply to Fine's theory. But composition as identity embraces the slogan more directly, by claiming that the whole is nothing over and above the parts in the perfectly literal sense of being literally identical to them. To those who feel the pull of composition as identity, this is the source of the attraction. As corollaries, Wallace's co-location may be avoided, and we may perhaps explain why Baxter's greedy owner now owns nothing.[24]

[23] Baxter (1988*a*,*b*) himself defends a more radical version; see Turner (2014) for discussion.

[24] In earlier work (2007) I complained that composition as identity cannot explain claims that are distinctive about parthood concerning the relation between a whole and a single one

Defenders of composition as identity normally accept classical mereology. Composition as identity would be even more attractive if classical mereology *followed from* it—or at any rate, if all those parts of classical mereology that can be regarded as being underwritten by the slogan followed from it. For then, composition as identity could be regarded as *the* way to make the slogan precise. But whether this can be done depends on the underlying plural logic one accepts. In section 3.2 of Sider (2007) I used arguments like those in section 1 to derive all of classical mereology except unrestricted composition from composition as identity. But my arguments assumed a plural logic with a primitive plural-term-forming operator.[25] In a more typical logical setting, the distinctive plural logical ideology consists solely of plural quantifiers and variables, plus the predicate 'is one of'; and in this setting I see no way to reconstruct my arguments. Plural referring terms are usually eliminable using the principle of plural comprehension, but full-strength comprehension is false given composition as identity. The natural weakening of comprehension is to "fusion-closed" pluralities (see Sider (2014)); but then certain principles of mereology must already be in place in order to apply this principle. (This problem does not confront the arguments of section 1, provided 'nothing over and above' is not claimed to obey an analog of Leibniz's Law.) So perhaps the best composition as identity has to offer to the project of clarifying "nothing over and above" is an *addition* to classical mereology.

4. Composition as identity and unrestricted composition

The relation between composition as identity and unrestricted composition is perplexing. Given my official formulation, composition as identity clearly does not imply unrestricted composition, not directly anyway. As officially formulated, composition as identity says merely that *if* there is a fusion of

of its parts individually, such as certain "inheritance" principles. I considered the response that the inheritance principles are just analytic, and replied that even if they are, we need an explanation of why alternate notions are intuitively bizarre (e.g., a notion of 'location' on which one is "located" wherever any of one's relatives are located). But, it may be replied, all that's needed is a story about what is special about the meanings we do adopt, and this can be given by the defender of composition as identity: they're special in that they're defined in terms of parthood (rather than being a relative, for instance), and parthood is distinctive because of how it's connected to identity!

[25] Furthermore, I did not consider the question of whether 'fusion' in composition as identity should be defined as Fu, Fu^*, or $\mathrm{Fu}^{\mathrm{lub}}$.

the Xs, then that thing is identical to those Xs; this apparently leaves open that the Xs simply have no fusion.[26] But there remains a persistent feeling that the intuitive idea of composition as identity really does imply unrestricted composition. If the whole is just its parts, then how could a whole fail to exist when the parts do? Perhaps the official formulation is too weak?

In section 1 I postponed discussion of whether unrestricted composition is underwritten by the slogan that "the whole is nothing over and above the parts"; now I can say why. On the one hand, the slogan seems to say merely that *if* there is a whole composed of certain parts then that whole stands in the "nothing over and above" relation to those parts, which apparently leaves open that there simply is no whole composed of those parts. On the other hand, *shouldn't* the slogan be understood so as to imply unrestricted composition?

Speaking for myself, I find it hard to shake the feeling that unrestricted composition is part of the intuitive picture that gives rise to the slogan, and also part of the intuitive picture that makes composition as identity so alluring. Thus I am moved to inquire: is there any view in the vicinity of composition as identity—perhaps a strengthened form of composition as identity, or perhaps a different view that is nevertheless in its spirit—from which unrestricted composition just falls out as a consequence?

4.1 Biconditional composition as identity

Formulating composition as identity "biconditionally", as the claim that $x \,\mathrm{Fu}\, Y$ if and only if $x = Y$, doesn't do the trick. Biconditional composition as identity doesn't imply that some x fuses any given Y; we need the added premise that for arbitrary Y, there is some x such that $x = Y$.

4.2 Identifying composition with identity

Maybe composition as identity should be construed so as to identify, not composites with their parts, but rather the composition relation with the identity relation—with, that is, the plural identity relation which can relate pluralities.[27] Take any Ys. By the reflexivity of plural identity, $Y = Y$. But if the identity relation is the composition relation, then given suitable connecting premises one ought to be able to conclude that Y is composed of Y.

[26] I pointed this out in Sider (2007, p. 61), and then went on to mention (without endorsing) certain indirect routes from composition as identity to unrestricted composition.

[27] McDaniel (2014) mentions this view.

One problem with this view is that it seems obviously wrong. The composition relation is defined in terms of parthood; how can it also be the identity relation? It may be replied that relations are more coarsely individuated than we normally think; but I don't quite see what intuitive picture this would come from.

A second problem is that the conclusion of the argument is merely that for any Ys, those Ys are composed of some Ys. But what we wanted is the conclusion that for any Ys, there is some x (singular) that is composed of the Ys. Identifying the composition and identity relations gets us nowhere.

4.3 No objective distinctions of number

Here's a (still) more bizarre attempt. Consider the following intuitive line of thought. For any Ys, there are some Xs such that $Y = X$, namely the Ys themselves. So we have $\forall Y \exists X\, Y = X$. Now, the gap we're struggling with is: how do we get from there to $\forall Y \exists x\, Y = x$? (If we could, then given biconditional composition as identity we'd be home free.) Answer: there isn't any objective distinction between manyness and oneness. The standard language of plural quantification makes a grammatical distinction between singular variables x and plural variables Y, and thus is problematic: it makes a notational distinction where there is no corresponding distinction in reality. English too makes the unfortunate grammatical distinction between singular and plural. A better language just has one sort of variable: $\alpha, \beta \ldots$. This language's "$\exists\alpha$" can be read indifferently as "there is something, α, such that…" or "there are some things, the αs, such that…".

In the preferred language of this account, there's nothing like the gap we were discussing above. We have only $\forall\alpha\exists\beta\ \alpha = \beta$, which will be regarded as a logical truth about identity.

But there is a related gap. If the slogan requires unrestricted composition to be true, it surely also requires the following to be true:

Existence of upper bounds $\forall\alpha\forall\beta\exists\gamma(\alpha < \gamma \wedge \beta < \gamma)$

"Any two 'things' are contained as parts by some further 'thing'"

What insures that this claim is true?

It may be responded that the theory is to include the axioms of classical mereology, including the principle of unrestricted composition, once those axioms are rewritten using the new variables. The existence of upper bounds follows from classical mereology thus understood.

At this point one wonders how the view differs from plain old classical mereology. But its defender might respond as follows. The comprehension schema for ordinary plural logic is the following, where ϕ may be replaced by any formula containing just x free:

Comprehension $\exists x\phi \to \exists Y \forall x(Yx \leftrightarrow \phi)$

> "Provided there's at least one ϕ, there are some things such that something is one of them iff it is a ϕ"

Instances of comprehension are often regarded as having a certain distinctive status.[28] They are thought of as being easy to know, not in need of explanation, as being "trivial", as being logical truths, and so forth. If you are committed to the existence of at least one kangaroo, it is said, then accepting the existence of some things that are all and only the kangaroos is no further commitment. The defender of the view we are considering might insist that unrestricted composition—understood using the new number-indifferent variables—has that same status. The "objects" on her view, after all, are objectively no different from "pluralities"; and she might make the additional claim that the parthood relation is not objectively different from the is-one-of relation.

The idea, then, is to insist on the propriety of thinking of the variables *both* as plural (thus making unrestricted composition not a big deal) and as singular (thus allowing us to think of those variables as genuinely denoting composite objects).

Notice that composition-as-identity's funny business with identity is no longer needed! We don't have any plural/singular distinction anymore, so we don't even have a way to say $X = y$.

My own view is that the alleged status of Comprehension is largely a mirage. For instance, even if accepting pluralities requires no further *ontological* commitment, it does require a further *ideological* commitment, which is a coequal way of "going out on a metaphysical limb" (Sider, 2011, 9.15).

But setting such concerns aside, the number-indifference view seems vulnerable to the following objection. Let x have no proper parts. Then, it would seem, x is objectively one. So the intuitive core of the view, that there is no objective difference between many and one, is untenable.

[28]See Lewis (1991, 3.2)

4.4 Fact identification

Defenders of composition as identity sometimes say things like this: "you can think of the many as many, or as one". But this actually suggests something quite different from a claim of many-one identity, namely that when we speak of many things existing, the fact that we are describing may also be described as a fact that involves the existence of one thing that is composed of those many. The nature of the fact itself does not call for a single fixed description.

On this view, the surprising identification is *not* between the one whole and the many parts; rather, the surprising identification is at the level of facts: the *fact* that the many exist is identical to the fact that there is also a one composed of them.[29] The view is not that things don't have a fixed nature as being many or one; it's that the facts don't have a fixed nature as being facts about many or one.

The idea that facts have no fixed ontological form has tempted many. There is, for instance, the idea of "content recarving" in neoFregean philosophy of mathematics. Agustín Rayo (2013) has recently articulated a version of this view; in his terms we could put the claim about parts and wholes as follows: for the parts to exist *just is* for the whole to exist in addition to those parts. There is also Eli Hirsch's (2011) quantifier variance, according to which there are multiple ways to understand quantifiers, each of which is adequate to describing the world. In Hirsch's terms, we could put the claim thus: no matter how we are initially using the quantifiers, if we can say truly that certain parts exist, then we are free to adopt a new, extended quantifier meaning under which we can say that there also exists a whole composed of those parts.[30]

The fact-identification idea could also be applied to various forms of *de*composition. Just as a whole composed of given entities automatically exists, it might be said, the parts of a given whole under any chosen decomposition also automatically exist. For a fact involving a spatially extended object, say, can always be redescribed as a fact involving a left half and a right half.[31]

At the start of the paper the target sense of 'nothing over and above' was said to be a relation between a thing and its parts. Thus the fact-identification

[29] I don't, though, think of the view as requiring a robust commitment to facts.

[30] Other views that are more or less in this spirit include those of Carnap (1950), Fine (2006, 2007), Jubien (1993, 2009), Thomasson (2007), and McDaniel (2013), who discusses the view that some entities are "no additions to being" in the sense of being in the range only of nonfundamental quantifiers.

[31] I'm tempted to read Hofweber and Velleman (2010) as implicitly presupposing some such view.

approach does not really capture that target sense. Nevertheless it strikes me as doing a lot of justice to some of the "nothing over and above" rhetoric. But those who find that rhetoric congenial may not feel the same way about content recarving or quantifier variance.

Some similar remarks apply to other "fact-level" interpretations of the slogan, such as the view that the fact of the whole's existence is grounded in the fact of the parts' existence, as defended by Ross Cameron (2014): though it does not really capture the target sense of 'nothing over and above', it does do justice to some of the rhetoric. Also in this vein, consider Trenton Merricks's (2001, 11–12) point that the elusive claim that a thing is nothing over and above its parts might simply be taken to say that the thing doesn't exist, only the parts do. Mereological nihilism—the view that composite objects do not exist—is therefore a possible interpretation of our slogan. And it becomes like the other fact-level interpretations we have been considering if the nihilist is willing to say: "although 'composites do not exist' is true in the language I am now speaking, we can introduce a new language in which 'there exists something composed of the Ys' has the same truth condition as 'the Ys exist' has in the language I am now speaking, and thus is true" (Sider, 2013*a*, section 3). For in so saying, the nihilist has accepted a sort of quantifier variance, albeit without the usual claim that all the quantifier meanings are on a par, and arguably has also accepted a form of Cameron's grounding view.[32]

5. Classical mereology again

In section 4 we sought an interpretation of composition as identity, or of the slogan that the whole is nothing over and above the parts, that implies unrestricted composition. But perhaps what we sought was right under our noses all along. Classical mereology, our first interpretation of the slogan, implies unrestricted composition, because unrestricted composition is one of its axioms.[33]

This might seem too thin. The slogan, it might be thought, calls for composites to "automatically" exist whenever the parts do. Classical mereology

[32]The latter subsumption is most apt under a "deflationary" approach to ground (in the sense of von Solodkoff and Woodward (2013)), of which I count my "metaphysical semantics" approach as an instance (Sider 2011, section 7.9, 2013*b*).

[33]Unlike the other axioms, unrestricted composition was not "derived" in section 1 from the slogan, so it may be objected that only the other axioms constitute an interpretation of the slogan. But the persistent feeling driving the previous section suggests otherwise.

does not deliver the automatic existence of composites; it merely asserts that they exist. But it's worth putting pressure on this notion of automaticity. What does it mean to say that something is automatically true, given certain other truths?

One sort of automaticity is material: universal truth-preservation, regardless of time or place. Since classical mereology says that *all* collections have fusions, no matter how they're arranged, the existence of a fusion in any given case *is* automatic in the material sense.

A stronger sort of automaticity is modal: truth-preservation regardless of the possible circumstances—necessary truth-preservation. But many defenders of classical mereology would say that its axioms aren't merely contingently true; they are necessarily true.[34] If so, then the existence of composites again counts as automatic. This may still seem too thin. But on closer inspection, it's unclear what more we might want.

A putatively stronger sort of automaticity is logical: truth-preservation by virtue of logic—logical consequence. A disjunction is automatically true in this sense, given a true disjunct. Since the axiom of unrestricted composition in classical mereology is not a logical truth, it may be argued, we have identified an important sense of automaticity in which classical mereology does not deliver the automatic existence of composite objects. But whether this is correct depends on the nature of logical consequence.

According to Quine's definition, for example, one sentence logically implies another just when it's not the case that the first is true and the second is false, and moreover, that this remains so no matter how one uniformly substitutes expressions for nonlogical expressions in the two sentences.[35] So in essence, disjunctions are logically implied by their disjuncts because i) 'or' is a logical expression and ii) in fact, as it happens, disjunctions always are true whenever they have a true disjunct. Now, the thesis of unrestricted composition contains (when formulated in primitive terms) only standard logical expressions—quantifiers, the identity sign, and boolean connectives—plus the predicate $<$ for parthood. So if $<$ counts as a logical expression too, then every expression in unrestricted composition is a logical expression, in which case its mere truth would suffice for its logical truth, given Quine's view. Thus the only thing standing in the way of saying that the existence of the whole is *logically* implied by the existence

[34]Cameron (2007) disagrees. My own view is that the necessity of unrestricted composition would amount to little more than its truth (Sider, 2011, chapter 12).

[35]Quine (1960); p. 103 in Quine (1966).

of the parts is the claim that 'part' is not a logical expression—a claim that is questionable, and moreover of questionable depth.

Quine's conception of logical consequence is often regarded as being too weak, since it allegedly leaves out the modal element of logical consequence; but certain natural strengthenings don't significantly alter the picture. Consider, for instance, the view that p logically implies q iff: it's *impossible* for p to be true while q is false, and moreover, this remains so for all uniform substitutions for nonlogical expressions in p and q. This too does not significantly alter the picture, if classical mereology is necessarily true. For then the implication of the existence of the whole from the existence of the parts is either logical, or else just like a logical implication except for the—shallow, I think—fact that $<$ does not count as a logical constant.

We are seeking a sense of automaticity under which the slogan demands, but classical mereology cannot deliver, the automatic existence of composite objects. The two conceptions of logical consequence we have considered so far, which did not lead to the desired sense of automaticity, were reductive. So perhaps a primitivist conception of logical consequence would fare better. Perhaps what the slogan really demands, and what classical mereology cannot deliver, is that the existence of the parts logically imply, in the primitive sense, the existence of the whole. Relatedly, a follower of Fine (2001, 2012, 1994) might try to capture the target sense of automaticity by saying that what the slogan demands, and what classical mereology cannot deliver, is that the existence of the whole be *grounded* in the existence of the parts, in some primitive sense of grounding, or that it be of the *essence* of mereological composition (or quantification, or identity), in some primitive sense of essence, that unrestricted composition hold.

But it is doubtful that these proposals really scratch the itch we are feeling. To bring this out, imagine someone who claimed that the existence of the whole *is* primitively logically implied by, or essentially implied by, or grounded in, the existence of the parts. Intuitively, such primitivist claims would not deliver the sort of automaticity we want (or think we want). For it would surely be natural to demand of the primitivist: *how* does the connection hold? What is the *mechanism* by which the connection holds; what is it, specifically, about composition, or identity, or quantification, that is responsible for the connection holding, and how does this specific feature of composition, identity, or quantification bring about the connection? The bare claim that the connection holds, absent a mechanism, feels no more satisfying than classical mereology's bare assertion that unrestricted composition is true. What we were doing in section 4 was seeking such mechanisms; the primitivist claims we are now considering amount to saying that some such mechanism exists without identifying it.

But if the mechanism is what we're really after, to scratch the itch, then the account of the automaticity given by plain old classical mereology doesn't look so thin after all. Each view considered in section 4 attempted to identify some claim (about composition, identity, or quantification) that would imply unrestricted composition. But unrestricted composition itself is a claim that implies unrestricted composition. If we could derive it from some other fact about parthood, composition, identity, or quantification, that would be nice; but then that further fact itself wouldn't have any deeper explanation. We can't escape unexplained explainers; at most, we can embed unrestricted composition in a unified and satisfying theory. The views discussed in section 4 attempt to do this, and perhaps they do it better than classical mereology. But classical mereology is also unified and satisfying in its own way.

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