

Are Ontological Debates Defective?*

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‘Metaontology,’ writes Ross Cameron (2008: 1), ‘is the new black’. He is right, but for reasons that run deeper than mere philosophical fashion. Metaphysics has been suspect at least since Hume told us to consign it to the flames, but its reputation reached a new low when the logical positivists announced it ‘eliminated’ (Carnap 1959) once and for all. And even though metaphysics has crept back into philosophical acceptability once again, proving positivist rumors of its death greatly exaggerated, lingering doubts plague its practitioners. As metaphysical inquiry has intensified, so has the skeptical itch of these doubts. No wonder, then, if we have finally reached the point where we cannot but scratch.

The itch is felt deeply by those metaphysicians asking *ontological* questions — questions about what there is. Carnap (1950) told us these questions were *defective*: either trivial or unintelligible. The spirit, if not the letter, of his position has chafed a number of contemporary philosophers — *defectors* — into agreement.¹

Many defectors find broadly linguistic fault with ontological questions: questions about what there is. We could choose to speak so as to make one answer to these questions come out true, or we could speak so as to favor another. Once we’ve settled how we’re speaking, there’s nothing left to ask. As a result, there is no deep fact of the matter as to which answer is right. Either opponents on different sides of an ontological question mean different things by ‘there is’ when defending their favored answers, in which case they’re speaking past each other, or ‘there is’ means the same thing in everyone’s mouth thanks to boring socio-linguistic factors. Either way, defectors reason, the debate is metaphysically shallow.²

Not all philosophers have defected. The faithful think most ontological questions remain substantial, despite the linguistic, broadly Carnapian specter of triviality. One strand of resistance has come from those who think that, even once we’ve settled how we’re speaking, there’s still a further metaphysical question to be asked: of our true uses of ‘there are *Fs*’ and the like, which ones are true because reality contains some mind-independent, self-standing things, *Fs*, which make the sentence true, and which are true only because a clever interpreter of language could cobble together an edifice on which they could stand? Which are the *substances* — the things sitting in the

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¹See e.g. Putnam 2004, 1987; Hirsch 2002*a,b*; Thomasson 2009; and Chalmers 2009.

²Hirsch 2002*a,b*.

world's ready-made domain, waiting to be discovered — and which are the mere *projections* of our linguistic practices?

My purpose here is twofold. First, I outline the contours of this contemporary *substantialist* resistance to Carnapian defection. Second, I consider the prospects for a Carnapian insurgence, undermining ontology and motivating defection from within the substantialist camp. I argue that the prospects are not good: considerations of logic make the substantialist rank hard to defect from.

1 PART 1: THE SUBSTANTIALIST RESPONSE TO DEFECTIVENESS

1.1 The Initial Puzzle

Consider the debate about what kinds of composite objects there are. Some ontologists — *compositional nihilists* — say that there are none.³ Others — *organicists* — say that the only composite objects are living things.⁴ The *compositional universalists* say that for any things whatsoever, no matter how scattered or gerrymandered, there is a composite object made up of just those things.⁵ And so on.

Here is a thought that animates a number of defectors.⁶ Suppose we discover (as seems likely) that, whenever we are around particles arranged in a certain, fairly well-defined way, we are inclined to say ‘There is a table here,’ and whenever we aren’t around particles arranged in that way, we say ‘There is no table here’. Then any reasonable view of the relationship between a sentence’s meaning and its conditions of use will make ‘There is a table here’ true when and only when uttered in the presence of so-arranged particles. But, since *all* parties in the composition debate agree that particles are sometimes arranged in this way — since all parties agree that there are sometimes particles ‘arranged tablewise’, as it were⁷ — why don’t they all agree, on boring socio-linguistic grounds, that sometimes ‘There is a table here’ is true? And so why don’t they agree that there are tables? (After all, ‘There is a table’ is true if and only if there is a table!)

The initial puzzle can be parlayed into an argument for defection:

³Cf. Rosen and Dorr 2002.

⁴E.g. Peter van Inwagen (1990). Trenton Merricks (2001) defends a similar, *causalist* view, sometimes confused with organicism, according to which the only composite objects are ones that have causal powers above and beyond those of their parts acting in concert.

⁵E.g. Lewis (1986: 212–213); Sider (2007); Van Cleeve (2007). More precisely, the view is that for any objects whatsoever, there is a thing that has all of them as parts and nothing as a part that doesn’t overlap at least some of them. An even more precise formulation is in §3.3.1.

⁶The following line of thought seems, to different extents, to capture concerns of defectors such as Eli Hirsch and Amy Thomasson.

⁷See van Inwagen 1990: 108–109 for a discussion of ‘arranged tablewise’ and related locutions.

- (i) Given the way we use our words, any decent theory of interpretation will make an ordinary use of ‘There is a table here’ true in any situation with particles arranged tablewise.
- (ii) The ontological question is just whether ordinary uses of ‘There is a table here’ are ever true.
- (iii) The debating parties *don’t* disagree about whether there are ever particles arranged tablewise.
- (iv) So there’s nothing left for them to be disagreeing about.

Those who want to resist defection must answer this argument.

1.2 A Diagnosis

One diagnosis of the above puzzle — and subsequent rejection of the argument it gives rise to — is that it relies on an overly deflationary picture of metaphysics. Metaphysics is not — at least, not in the first instance, not *primarily* — about which ordinary sentences are true. And ontology is not primarily about which ordinary sentences beginning ‘There is’ are true. Both are about something deeper: the *structure of reality*.

1.2.1 Modality

Compare a different metaphysical debate. David Lewis (1986) famously reduced talk about what could or couldn’t be the case to talk about what is or isn’t the case in various disconnected spacetimes. He was a modal *reductionist*. Others — *primitivists* — replied that any reduction of the modal to the non-modal is a mistake: possibility and necessity should be taken as *primitive*, not to be analyzed away, a real fundamental feature of the world. (Cf. Plantinga 1987)

Lewis and the primitivist both agree that ordinary utterances of ‘There could have been talking donkeys’ are true, and that those of ‘There could have been round squares’ are false. And, even though Lewis thinks that ordinary utterances (if any there be) of ‘There are disconnected spacetimes’ are true, the primitivist doesn’t have to disagree. She might say:

I’m happy to grant that there *are* these disconnected spacetimes, and that they are filled up with talking donkeys and the like as Lewis says. I’ll even grant that, for every way the world could have been, there is a disconnected spacetime that is that way; I’ll grant that possibly, *P* iff *P* is true in some disconnected spacetime. I just don’t think this biconditional could give us an *analysis* of possibility. Maybe there is a disconnected spacetime with talking

donkeys, but that's not *why* there could have been talking donkeys. That there could have been talking donkeys is itself a brute fact, not to be further explained or analyzed.⁸

Whether we agree with her or not, we understand this primitivist's objection. But it is an objection not about what the truth-values of ordinary utterances are, but about *how* these utterances get their truth-values. Lewis thinks the story about how modal truths are made true involves disconnected spacetimes; the primitivist does not. The primitivist, by refusing to reduce modal notions, thinks modal facts are written into the fabric of the universe; if we want to 'carve nature at its joints', in Plato's (*Phaedrus*, 265d–266a) phrase, we need to make some distinctively modal cuts. Lewis disagrees: modality isn't to be found in reality's ultimate structure, but is to be cobbled together from other sources that are.

Lewis and the primitivist phrase their disagreement in terms of analysis, but it is at root about the structure of reality. When a metaphysician gives an analysis of *A* in terms of *B*, *C*, ..., she says that not just that *A* co-varies systematically with *B*, *C*, ..., but also that the *B*, *C*, ... features are more structurally basic than *A* — they carve reality closer to its joints than *A* does. These are *metaphysical* analyses, rather than conceptual ones; they plumb not the structure of our conceptual scheme, but rather the structure of reality itself.⁹ A metaphysician's *primitive* expressions are the ones she does not analyze at all, and correspond to reality's ultimate structural joints.

1.2.2 Substances

Just as, on this picture, questions about modality aren't in the first instance about the truth-values of ordinary utterances, so for questions of ontology. The ontologist need not worry about whether 'There are three new hairstyles in fashion this summer' can be true; rather, he should worry about whether any story about how the world makes it true appeals to certain entities, *hairstyles*, which make it true. If he can analyze the hairstyles away somehow, then in a sense there aren't *really* hairstyles, despite the truth of ordinary utterances of 'There are hairstyles'.¹⁰

This is apt to seem a bit woolly — if 'There are hairstyles', is true, in what sense aren't there 'really' any hairstyles? But we can be more precise. Consider a sentence such as

⁸See e.g. Plantinga 1979: 114–120, 1987: 209–213 and Salmon 1988: 239–240. Cf. also Kripke's famous Humphrey objection (1972: 45 fn. 13), where the complaint isn't that there are no suitable objects to be Humphrey's counterpart, but rather that Humphrey's counterpart is irrelevant to Humphrey's modal profile.

⁹Dorr 2004: 155–158, 2005: 216–266. See also Fine 2001; Sider 2009; and Hawthorne and Cortens 1995: §5.

¹⁰Cameron 2010.

(1) There are three hairstyles in fashion this summer.

We might analyze (1) in either of two ways. First: the predicates ‘is a hairstyle’ and ‘is in fashion this summer’ might each be metaphysically analyzed in some way or another — perhaps as ‘F’ and ‘G’, respectively. Then, although (1) would admit of a metaphysical analysis, its analysans,

(2) There are three x s such that: Fx and Gx ,

wouldn’t.¹¹ In this case, although (1) would not be basic, the hairstyles — the things in fact satisfying ‘F’ and thereby making ‘There are hairstyles’ true — would. The world would need some special things to go around being F in order for their to be hairstyles.

Suppose instead that (1) was given a different sort of analysis — perhaps as a large disjunction of sentences of the form

(3) People are asking to have their hair styled like thus-and-so, and also like such-and-such, and also like so-and-such, this summer,

with the ‘thus-and-so’s filled in by detailed tonsorial descriptions. Presumably (3) will come in for further metaphysical analysis, but that won’t matter: apparent quantification over things that are hairstyles has gone away, and it won’t come back under further analysis. The metaphysical story behind (1)’s truth doesn’t appeal to something satisfying ‘hairstyle’ (or its metaphysical analysans).

Suppose that ‘hairstyle’ talk can be analyzed away along the lines of something like (3). And suppose (as seems likely) that particle talk can’t. That is, suppose there is no way to metaphysically analyze sentences of the form

(4) There is a particle such that ...

that doesn’t have reality supplying a satisfier for ‘particle’ (or its metaphysical analysans). Then particles would be very metaphysically different than hairstyles. Reality privileges particles in a way it doesn’t privilege hairstyles: it uses the former, but not the latter, as part of its toolkit for making various claims true.

In this case, we might reasonably call particles but not hairstyles ‘substances’. After all, in a certain sense, hairstyles don’t exist ‘in themselves’: insofar as they exist at all, they do so only as projections of our linguistic practices. They are epiphenomena of our habit of uttering (1) and its ilk. There are no hairstyles ‘in reality’ making hairstyle-talk true; hairstyles disappear under analysis. Particles do exist ‘in themselves’: they would have existed regardless of whether we ever spoke of them, because reality would need them in its toolkit for making true other of our claims.

¹¹Perhaps ‘There are three x s’ needs to be metaphysically analyzed in terms of ‘ \exists ’ and ‘=’, but set that aside for now.

We can make this picture more precise. Let a metaphysical theory \mathcal{T} consist of a set of (interpreted) sentences, S , closed under logical consequence and taken to be true, plus a set of metaphysical analyses A . Call an expression *primitive* (in \mathcal{T}) if it has no analysis in A . And call the subset of S that uses only primitive expressions the *core* of \mathcal{T} .

Now we say that something is a *substance* (according to \mathcal{T}) if and only if the variables in \mathcal{T} 's core have to range over it if \mathcal{T} is to be true; and F s are substances generally (according to \mathcal{T}) if and only if either $\exists xFx$ is in \mathcal{T} 's core, or the predicate ' F ' is metaphysically analyzed as ϕ (open in x) by \mathcal{T} , and $\exists x\phi$ is in \mathcal{T} 's core. More simply: the substances, according to a theory, are the things which the theory says cannot be analyzed away.

1.3 A Different Diagnosis?

The diagnosis I just offered recommends soothing the defective itch by rejecting (ii). An alternative diagnosis recommends a different remedy — which can be cooked up from the same ingredients — in rejecting (i).

Following Lewis (1984, 1983: 45–55), we might think that there is an *eligibility* constraint on interpretation: expressions are interpreted to give them, *ceteris paribus*, meanings with a special metaphysical status. We might combine this with the further thought that the special metaphysical status is something like 'closeness to the joints of nature'.

If we thought this, then expressions which had no metaphysical analysis would be very fundamental indeed. But now take the core of the true metaphysical theory. It will use an existential quantifier ' \exists '.¹² That existential quantifier might also occur somewhere outside of the core; but now consider a quantifier ' \exists^* ' which is restricted to range over only the domain required to make sentences in the core theory true. Call this new expression the *core quantifier*.¹³ It will be about as eligible as expressions come. And we might even think it is so eligible that, despite how we might use it in ordinary conversation, ordinary uses of 'there are' gets the core interpretation.

If we think all of this, we will deny (i) of the argument for defection. We will think it open that, even though we tend to say 'There is a table here' in and only in the presence of particles arranged tablewise, the core quantifier just doesn't combine with 'a table' to deliver a truth. And if eligibility trumps use in a way that makes ordinary uses of 'there are' pick out the

¹²Perhaps it will contain a universal one instead, in which case ' \exists ' will not be unanalyzable, but close enough as to make no difference for present purposes. Or perhaps the theory aims to analyze everything into an 'ontology-free' core theory; I have argued against such theories in Turner 2011, and won't consider them further here.

¹³Note that the core quantifier might not be a restriction of the ordinary quantifier, because if there are more things in our philosophy than are dreamt of in our ordinary language, \mathcal{T} 's quantifier will need a wider range than the ordinary one. It is \mathcal{T} 's quantifier — not necessarily yours or mine — that the core quantifier restricts.

core quantifier, then ‘There is a table here’ will be false in the presence of chairwise-arranged particles.¹⁴

But this rejection of (i) leaves something to be desired. Even if eligibility constrains interpretation, it must be balanced out by other constraints, such as charity: make us speak truths more often than not, and make our falsehoods understandable.¹⁵ We continuously and confidently assert ‘There is a table here’ in the presence of particles arranged tablewise; this provides tremendous pressure from charity to make these assertions true. In order for an uncooperative joint-carving interpretation to make them false, the pressure from eligibility must be immense.¹⁶ But if eligibility is this powerful, how do we ever manage to use expressions that *don’t* have similarly core meanings? Why doesn’t every predicate latch onto some fundamental property of physics or metaphysics, if every use of a quantifier has to latch onto the core quantifier?

But the substantialist need not settle this difficult interpretative issue. Even if Lewisian eligibility considerations make (i) false and (ii) true, she should reject (ii) in spirit.¹⁷ The thought behind (ii) is that, ultimately, ontology is all about the truth of ordinary sentences. The substantialist thinks that ontology is about the substances, not the ordinary utterances. If a certain metasemantic thesis comes out true, then the ordinary utterances track the substances. But in that case, the truth of (ii) is a fortuitous deliverance from another field. The substantialist’s heart does not lie with ordinary assertions, but with the substances — the domain of the core quantifier.

2 MIGHT A SUBSTANTIALIST DEFECT?

Metasemantic concerns irritate some into defection, but the substantialist resists by applying as salve a picture of metaphysical theorizing with metaphysical analyses at the forefront. Some may worry this salve itself will inflame further defection.

To see why, return again to the modal primitivist of §1.2.1. She takes the true metaphysical theory’s core to use modal operators. But since ‘ \Box ’ and ‘ \Diamond ’ are (with the help of a negation) interdefinable, she need not take *both* as primitive. One can be analyzed in terms of the other. But which one? To choose either seems arbitrary; to choose neither, theoretically excessive.

Here’s an attractive thought: we have to choose one, but it doesn’t matter which one we choose; either choice would be equally good. Nature has only

¹⁴Sider 2001a,b: xvi–xxiv

¹⁵Better: make people’s behavior rational (Lewis 1974: 112–114) and maximize knowledge (Williamson 2004: 139–147).

¹⁶Hirsch 2005: 90–97, 2007: 377.

¹⁷Similarly if (i) is undermined by considerations such as those raised by Matti Eklund (2007) and John Hawthorne (2006).

one modal joint, but the vagaries of language force us to represent it in one of two equally good ways.

How to integrate this thought with the analysis-driven picture of metaphysics? Simple: allow metaphysical theories where ' $\sim\Box\sim$ ' counts as an analysis of ' \Diamond ' and ' $\sim\Diamond\sim$ ' counts as an analysis of ' \Box '. In this case, we say that each is an *improper* analysis of each other.¹⁸ (Proper analyses are analyses that only go in one direction, of course.)¹⁹

If we allow for metaphysical theories with improper analyses, we will have to re-define a theory's 'core'. Here's the intuitive idea: when we have improper analyses, we have a choice about which way to make the analysis go. Either choice results in a different core theory, so a metaphysical theory with some improper analyses gives us several cores.

More precisely: if A is a set of metaphysical analyses, call a subset A' an *analytically proper* subset iff it doesn't contain any expressions that analyze each other, and call it a *maximal proper* subset if it's not contained in some other analytically proper subset of A . For any such A' , call the expressions it does not analyze *primitive relative to A'* . Now we define the core of a metaphysical theory relative to any such A' as those sentences of the theory that only use expressions primitive relative to A' . A core *simpliciter* of a theory is any core relative to some such A' . Every theory has at least one, and perhaps several, cores — one for each analytically proper maximal subset of the theory's analyses.

Anyone who thinks that the true metaphysical theory has multiple cores will think certain potential debates misguided. For instance, the modal primitivist who thinks that the true metaphysical theory has one core with ' \Box ' instead of ' \Diamond ' and another which goes the other way will look askance at a debate about which of ' \Box ' and ' \Diamond ' carves reality at its joints. That's not to say that she will think the debate isn't in some sense substantive: she will view each party to it as endorsing a different metaphysical theory from hers. But she will think that each of them has got only a part of the truth: they each endorse everything she does, save one further analysis. And she will suspect they were only led into their dispute because they mistakenly took their respective theories to be the only viable alternatives; they hadn't considered

¹⁸I'm assuming that metaphysical analyses are transitive, so if there are ever closed circles of analysis, every member of the circle is an analysis of every other. If analysis is intransitive, we could have a situation where α analyzes β , β analyzes γ , and γ analyzes α , but no two expressions analyze each other. We'd want a general definition of improper analysis that would rule these in, and we could get it in various ways.

¹⁹We might instead prefer a view on which it is metaphysically indeterminate whether \Diamond is analyzed in terms of \Box , or *vice versa*, but it is metaphysically determinate that one is analyzed in terms of the other. If we define ' X properly analyzes Y ' as 'it is determinate that X analyzes Y ' and ' X improperly analyzes Y ' as 'it is not determinately not the case that X analyzes Y and not determinately not the case that Y analyzes X ', on minimal assumptions we can reconstruct the entire discussion below.

the possibility of the true theory's having two cores, and so were led to argue about what is in fact a non-issue.

The worry for the substantialist is that something similar might be going on with ontological debates. Perhaps the true metaphysical theory \mathcal{T} has two quantifier expressions: ' \exists_U ' and ' \exists_N ', where

(5) $\exists_U x(x \text{ is a composite object})$

is true but

(6) $\exists_N x(x \text{ is a composite object})$

is false. And perhaps each of these is (improperly) analyzed (with the help of some further resources) in terms of the other, so that one core theory looks like mereological universalism (using ' \exists_U '), whereas another looks like mereological nihilism (using ' \exists_N ').

This wouldn't make the ontological debates defective in quite the same way that the argument from §1.1 did. There would still be something for ontologists to argue about — namely, whether the true metaphysical theory had only ' \exists_N ' as primitive, or only ' \exists_U ' as primitive, or allowed us to choose whichever we like. But it provides a live theoretical option, from the substantialist's perspective, of the debate being misguided: both parties, by ignoring a more inclusive theory, may have deluded themselves into thinking either universalism or nihilism must be the unique mereology of the substances. And it raises a disturbing spectre: might there in fact not be any substances absolutely, but only relative to different, equally metaphysically acceptable, choices of what to take as primitive? Might the question as to whether the substances ever compose something be just like the question as to whether modality is about necessity or about possibility instead? Might there be a real sense in which *we* get to choose how we want to divide reality into substances?

3 BLOCKING SUBSTANTIAL DEFECTION: LOGIC TO THE RESCUE

No. Or so I will argue in the balance of the paper. The argument goes like this: in order for a theory to have two cores, these cores must meet a certain logical constraint. But, when the core theories are mereological nihilism and universalism, they cannot meet this constraint. So a metaphysical theory cannot have two cores, one which is nihilistic and the other which is universalistic.

That's not enough, of course, to show that a theory cannot have two cores that result from some sort of analysis of one existential quantifier in terms of another. But defectors have found the universalist/nihilist debates a paradigm of defectiveness: it looks so easy to think of both sides as simply

talking in different ways about the same things, the ‘particles’ (mereological atoms).²⁰ If we can show this debate isn’t a candidate for substantial defection, we make a strong *prima facie* case that few will be. And if worries for other debates remain, the argument here can serve as a template for future arguments against substantial defection.

I will first explain the requirement that cores need to meet (§3.1). I’ll then run through an informal example of how that requirement can spell trouble for substantial defection (§3.2). A more general argument follows (§3.3), after which a few objections are rebutted (§3.4).

3.1 Logical Constancy

3.1.1 A Tempting Line of Thought

Suppose that, by swapping metaphysical analysands for analysandum, ϕ can be turned into a logical truth. Then, although ϕ itself might not be a logical truth, it cannot be false. It is, after all, just a disguised expression of a logical truth, which cannot be false. Call such ϕ *metaphysically analytic*.²¹

Likewise, suppose that, by swapping metaphysical analysands for analysandum, ϕ and the sentences in Δ can be turned into ψ and Γ , where ψ is a logical consequence of Γ (written $\Gamma \Rightarrow \psi$). Then the sentences of Δ cannot be all true while ϕ is false for similar reasons. In this case, call ϕ a *metaphysical consequence* of Δ . Note that a metaphysically analytic sentence is a metaphysical consequence of every set of sentences, including the empty one.

If \mathcal{T} is a theory, let \mathcal{L} be its language. So long as \mathcal{L} ’s logic is settled, \mathcal{T} will settle metaphysical analyticity and metaphysical consequence; we don’t need to make a decision about which way to go on the improper analyses to determine which sentences are metaphysical consequences of which. An upshot is that metaphysical consequence is preserved whenever we swap metaphysical analysands and analysandum.

Notice that each core T of a metaphysical theory \mathcal{T} will have its own language, L , which will be a fragment of \mathcal{L} . L will, in fact, consist of all and only those expressions of \mathcal{L} which are primitive relative to T . Call it a *core language*. Suppose there are two cores, T_1 and T_2 , and a sentence ϕ in the language L_1 associated with T_1 . Then we can *translate* ϕ into L_2 as follows: If ϕ has any expressions in it that aren’t primitive in T_2 , we swap those expressions for their analyses in terms that are primitive in T_2 ; otherwise, we leave it alone. Let t be the ‘translation function’ defined this way; it has the job of taking sentences in any one core and finding their metaphysical equivalents in the other.²²

²⁰See e.g. Putnam 2004, 1987; Hirsch 2002a,b.

²¹Dorr 2004: 157–158.

²²Strictly speaking, there will be several translation functions: two for each pair of cores

Suppose a metaphysical theory \mathcal{T} has, in a core T_1 , a metaphysically analytic sentence ϕ . Then there must be some core T_2 that contains $t(\phi)$, and $t(\phi)$ must be a logical truth.²³ It is very tempting to then think that ϕ must also be a logical truth. The tempting line of thought goes like this:

Tempting Line of Thought:

The core of a theory is its *explanatory* core: the bit of the theory that explains everything else. Being metaphysically analytic, ϕ has a property that calls out for explanation: it cannot be false. The core T_2 can explain it; it explains it by translating ϕ into a logical truth.²⁴ But if ϕ wasn't a logical truth already, then T_1 couldn't explain something that T_2 can — ϕ 's modal status — which would suggest T_1 wouldn't really be a core after all. Since T_1 is a core, it must be able to explain ϕ 's modal status, and so ϕ must be a logical truth.

The Tempting Line of Thought thus gives the following principle: for ϕ in the language of a core theory, if $\Rightarrow t(\phi)$, then $\Rightarrow \phi$.

If this principle is right, it can be strengthened. Here's why. If T_1 and T_2 are both cores of a single metaphysical theory, then the translation function between their languages will meet another condition. If α and β are improper analyses of each other, then the result of starting with ϕ , changing out all α -expressions for their β -analysands, and then changing back all β -expressions for their α analysands ought to give us something equivalent to what we started with. For instance, if we start with ' $\Box\phi$ ', cash the ' \Box ' in for ' $\sim\Diamond\sim\phi$ ', and then trade the ' \Diamond ' in for its analysands, we get ' $\sim\sim\Box\sim\sim\phi$ ' — equivalent to ' $\Box\phi$ '. Since analysis is supposed to give us the same content expressed a different way, if we didn't have this sort of situation, we wouldn't think ' \Box ' and ' \Diamond ' — or any α and β similarly posed — analyzed each other. So, as a result, for any translation function between cores, we have

Recoverability: $t(t(\phi)) \Leftrightarrow \phi$.

And Recoverability combined with the principle above generates

Naïve Logical Constancy: if ϕ is in a core language, then $\Rightarrow \phi$ iff $\Rightarrow t(\phi)$.²⁵

of \mathcal{T} . But we'll restrict ourselves to considering cases where there are only two cores (and so only two translation functions), and use ' t ' for both, letting context disambiguate which direction the translation is going.

²³Of course, ϕ might be a logical truth itself, and in this case t might just be the identity function.

²⁴You might think we still need to explain why logical truths have this property. Fair enough; but we were going to need that *anyway*. We at least have a relative explanation as to why ϕ has the property, and reason to think a full explanation exists.

²⁵Suppose $\Rightarrow \phi$; then $\Rightarrow t(t(\phi))$ by Recoverability, so $\Rightarrow t(\phi)$ by the above principle.

3.1.2 Fixing the Thought

The Tempting Line of Thought can't be quite right, though, because naïve constancy admits of counterexamples.²⁶ Friends of mereology frequently distinguish between *proper* and *improper* parts. An improper part of something is the thing itself; a proper part is any part that isn't improper. It turns out that classical extensional mereology can be axiomatized with a *proper* parthood relation which excludes improper parts, or with a *generic* parthood relation that includes them.

In the context of classical extensional mereology, we can start with proper parthood, 'P', and define generic parthood, 'GP', by

$$(7) \ 'xPy \vee x = y'.$$

Likewise, we can start with generic parthood and define proper parthood by

$$(8) \ 'xGPy \ \& \ x \neq y'.$$

For a universalist who endorses classical extensional mereology, the choice between whether to take proper or generic parthood as primitive looks like a mere matter of notation. A debate between two universalists on this matter would plausibly be regarded as defective, similar to a debate between two modalists over whether to regard necessity or possibility as primitive. So there ought to be a universalist metaphysical theory \mathcal{U} that has two cores — one that takes 'GP' as primitive, and one that takes 'P' as primitive.

But Naïve Logical Constancy can't accommodate this plausible thought. Consider

$$(9) \ \forall x(xGPx),$$

a theorem of classical extensional mereology. In a core that takes 'GP' as primitive, it is not a logical truth. But if analyzed via (7) into a core that takes 'P' as primitive, it becomes

$$(10) \ \forall x(xPx \vee x = x),$$

which is a logical truth.

The tempting line of thought goes wrong by assuming that the only way a core can explain the modal properties of metaphysically analytic sentences is by making them logical truths. Plausibly, though, a friend of classical extensional mereology will think that the mereological axioms are themselves deeply necessary — necessary in a way that explains the necessity of other, related claims.²⁷ One core explains (9)'s necessity by making it a logical truth;

²⁶Thanks here to Cian Dorr.

²⁷There are some, at least, who think that the status of various mereological axioms is contingent (Cf. Cameron 2007). They, I take it, cannot straightforwardly follow me here.

the other does so by having it follow logically from claims that are themselves necessary, namely the axioms of classical extensional mereology.

More precisely: \mathcal{U} will contain two cores, T_P and T_{GP} ; one includes only 'P', and the other includes only 'GP'. Each of these will also contain what the universalist views as an *axiomatization* of classical extensional mereology: A_P , in T_P , which axiomatizes mereology in terms of proper parthood, and A_{GP} , in T_{GP} , which axiomatizes mereology in terms of generic parthood. And the alternative axiomatizations A_P and A_{GP} will be thought to have equal explanatory power when it comes to explaining the necessity of metaphysical analyticities (at least those relating to mereology). For such metaphysical analyticities ϕ , their analyses in T_P will be a logical consequence of A_P if and only if their analyses in T_{GP} is a logical consequence of A_{GP} .

The Tempting Line of Thought, while on to something, missed the explanatory importance of 'axiomatizations' in alternative cores. That Line of Thought should have ended:

... Since T_1 is a core, it must be able to explain ϕ 's modal status, and so ϕ must be a consequence of T_1 's axiomatization.

This Modified Tempting Line of thought, along with Recoverability, gets us

Sophisticated Logical Constancy (i): if ϕ is in a core language L_1 , $A_1 \Rightarrow \phi$ iff $A_2 \Rightarrow t(\phi)$,

where A_1 and A_2 are understood to be the axiomatizations associated with the core theories written in L_1 and L_2 .

Finally: we have thus far focused on metaphysically analytic sentences and logical truth. But everything that has been said above holds equally well for metaphysical and logical *consequence* as well. If ϕ is a metaphysical consequence of Δ , a special modal relationship holds between ϕ and Δ , and calls out for explanation. Any core in which $\Delta \Rightarrow \phi$ has such an explanation, so every other core must have an explanation, too. Since that explanation can appeal to the axiomatizations, we get

Sophisticated Logical Constancy (ii): For Δ and ϕ of a core language L_1 , $A_1 + \Delta \Rightarrow \phi$ iff $A_2 + t(\Delta) \Rightarrow t(\phi)$.

We'll call this principle just 'Logical Constancy' for short, and we'll call a translation function *t constant* if it satisfies this constraint.

3.1.3 Conservatism

Given Recoverability and Logical Constancy, we can show that *t* will be

Truth-Functionally Conservative: The translation of a truth-functional compound of sentences is logically equivalent, given the axiomatization, to the same compound of the translation of its parts.

For instance, where A' is the axiomatization for the core that P and Q live in, and A the axiomatization for the core that their translations under t live in, we can argue as follows:

- (i) $A' + P \ \& \ Q \Rightarrow P$ premise
- (ii) $A + t(P \ \& \ Q) \Rightarrow t(P)$ i, Constancy
- (iii) $A' + P \ \& \ Q \Rightarrow Q$ premise
- (iv) $A + t(P \ \& \ Q) \Rightarrow t(Q)$ iii, Constancy
- (v) $A + t(P \ \& \ Q) \Rightarrow t(P) \ \& \ t(Q)$ ii, iv

A similar argument will show that $A + t(P) \ \& \ t(Q) \Rightarrow t(P \ \& \ Q)$, and from this it follows that $t(P) \ \& \ t(Q)$ is equivalent to $t(P \ \& \ Q)$ under A ; likewise for all the truth-functional connectives (see appendix).

We might think we can show further that such a translation is also

Quantificational Conservatism: $A \Rightarrow t(\exists x\phi) \leftrightarrow \exists xt(\phi)$.

If we thought this, we might try to then raise trouble for substantial defection. For instance, we might use quantificational conservatism to argue that any counting sentence using ' \exists_U ' that says there are_U exactly n things will go over into one which uses ' \exists_N ' to say there are_N exactly n things. But since the substantial defector ought to think that there are_N exactly two things when and only when there are_U exactly three things — since whenever there are exactly two mereological atoms, the universalist will say there are exactly three things — he will be driven to reductio.

But we will have a hard time establishing quantificational conservatism. If we argue for quantificational conservatism along the above lines, we get in the right-to-left direction:²⁸

- (i) $A' + \phi \Rightarrow \exists x\phi$ premise
- (ii) $A + t(\phi) \Rightarrow t(\exists x\phi)$ i, Constancy
- (iii) $A + \exists xt(\phi) \Rightarrow t(\phi)$ premise
- (iv) $A + \exists xt(\phi) \Rightarrow t(\exists x\phi)$ ii, iii

For Quantificational Conservatism to pose any threat to substantial defection, it had better hold when ϕ is an open formula. (Otherwise the conclusion wouldn't tell us, for instance, that $A + \exists xt(Fx) \Rightarrow t(\exists xFx)$.) And this means that Logical Constancy had better apply to open ϕ . But the (Modified) Line

²⁸There's nothing special about this direction; the same problem crops up proving left-to-right. Note that A' here is the axiomatization of the core corresponding to whatever language ϕ lives in.

of Thought supporting Logical Constancy only applied to sentences; it didn't license any conclusions about open formulae. The idea, more or less, is that without constancy, the modal relationship between ϕ and Δ could not be explained within the core that held them both. To extend the reasoning, we would need to argue that a similar modal relationship holds between an open formula ϕ' and a set Γ' containing open formulae.

But a substantial defector is going to be skeptical of the proposed relationship. What is it? The impossibility of having *these* open formulae all be true while *that* one is false? This talk of truth or falsity of open formulae isn't well-defined. We could try to define it, Tarski-style, by appeal to formulae satisfaction. But that will make sense only if there are some ready-made objects hanging around to satisfy formulae. If (i) expresses a logical relationships involving open formulae that can do serious explanatory work, the objects doing the satisfying will need to be substances. Since the defector thinks there is no single deep fact about what the substances are, he won't think there is any single deep satisfaction relation he has to recognize, and so no deep and univocal sense of ' \Rightarrow ' applying to open formula he has to worry about. Since we can't define into existence a relationship involving open formula that he will have to take seriously, unless we can find a way to argue independently that he should believe in logical relations between open formulae, we'll get no mileage out of Quantificational Conservatism.²⁹

3.2 The Argument: A First Pass

Here is one way a proposed set of analyses can run into trouble with logical constancy. The compositional nihilist insists that, although there are particles arranged chairwise, there are no chairs. The universalist replies that there are chairs in addition to particles arranged chairwise. Both parties take themselves to be arguing about what substances there are. But the substantial defector claims their debate is notational: in the *true* theory (the one he endorses), there are two candidate quantifiers to give us the substances: ' \exists_N ', which makes both of

(11) $\exists_N xx$ (xx are particles arranged tablewise)³⁰

(12) $\sim \exists_N x$ (x is a table)

²⁹The problem can be put another way. We're dealing so far with an intuitive notion of ' \Rightarrow ', corresponding to a pre-theoretical understanding of logical consequence. That understanding applies to sentences, but not (or at least not obviously) to open formula. Unless we can argue that, by his own lights, the substantial defector ought to recognize some sort of (unique) extension of that pre-theoretical relationship to open formula, we'll have nothing with which to move him. And he is going to be very hesitant to understand anything with which we might try to so force him.

³⁰' $\exists_N xx \dots$ ' is a plural quantifier; this will matter soon, but we'll ignore some complications for now.

true; and ‘ \exists_U ’, which makes both of

(13) $\exists_U xx$ (xx are particles arranged tablewise)

(14) $\exists_U x$ (x is a table)

true.³¹ Each of these quantifiers belongs to a different core; as a result, we can choose what we want to mean by ‘substance’, and there’s no fact of the matter as to whether, independent of such a choice, ‘the substances’ act the way the universalist or the nihilist says they do.³²

How does this defector think the translations between the two cores go? Here’s a thought that has influenced defectors generally: when the universalist says (14), he’s really saying the same thing that the nihilist says when she says (11). If the substantial defector follows this line of thought, he will say that $t((14))$ is (11).

How is the defector then going to translate (13)? There aren’t a lot of options: the best candidate looks to have it go to (11) as well. But this leads to a problem. For, where U is the axiomatization of mereological universalism,

$$U + (14) \not\Rightarrow (13)$$

Nothing in mereological universalism says that tables can only exist if they’re made up of particles arranged tablewise; perhaps extended simples, or properly shaped fields of force, or ideas in the mind of God could be tables, too.³³ Thus, by Logical Constancy, where N is the axiomatization of mereological nihilism, we have

$$N + t((14)) \not\Rightarrow t((13))$$

But plugging in the proposed translations, we get

$$N + (11) \not\Rightarrow (11)$$

which, of course, is absurd.

No defector will give up this easily, of course; he will insist that we’ve stacked the deck with a carefully chosen (and not very plausible) translation scheme. If we want to truly resist defection, we’ll need a much more general argument.

³¹More precisely, each quantifier *allows* the first sentence in the following pair to be true, and then *makes* the second true when it is. (Although (12) is made true no matter what.)

³²Note that (12) and (14) are probably not in any core theory, because they use the expressions ‘particles arranged tablewise’ and ‘is a table’, which will likely be analyzed into something more basic. But these sentences are about substances, because they use the core quantifiers.

³³Of course, this won’t work if U also has an axiom to the effect that tables must be composed of particles arranged tablewise. Let’s not fret over this now; the current example is for illustrative purposes only, and the argument in section 3.3 won’t be susceptible to such worries.

3.3 A More General Argument

3.3.1 The Languages

According to the defector, the metaphysical theory has one ‘universalist’ core — call it U — and one ‘nihilist’ core — call it N . Let’s suppose their languages (L_U and L_N) have the same resources: plural and singular quantifiers, logical predicates of identity ($=$) and one-of (\prec : ‘John \prec the Beatles’ means that John is one of the Beatles), and for simplicity, just one non-logical predicate ‘P’ that means *is a (proper) part of*. ‘P’ takes singular (not plural) terms and arguments. The only linguistic difference between the cores is that U has a ‘universalist’ existential quantifier, ‘ \exists_U ’, which the defector says is improperly analyzed by N ’s quantifier ‘ \exists_N ’.³⁴

Theory N is easy to axiomatize:

$$(N) \forall_N x \sim \exists_N y Pxy$$

The universalist’s theory is axiomatized by several claims, best stated with the help of the following abbreviations:

(GP) *Generic part*: ‘GPxy’ abbreviates ‘ $Pxy \vee x = y$ ’.

(O) *Overlap*: ‘Oxy’ abbreviates ‘ $\exists_U w (GPwx \ \& \ GPwy)$ ’.

(F) *Fusion*: ‘Fyxx’ abbreviates ‘ $\forall_U z (z \prec xx \supset GPzy) \ \& \ \forall_U z (GPzy \supset \exists w (w \prec xx \ \& \ Owz))$ ’.³⁵

Since it is a classical mereological theory, U has as axioms:

(Tr) *Transitivity*: $\forall_U x \forall_U y \forall_U z ((GPxy \ \& \ GPyz) \supset GPxz)$

(WS) *Weak Supplementation*: $\forall_U x \forall_U y (Pxy \supset \exists_U z (GPzy \ \& \ \sim Ozx))$

(UC) *Universal Composition*: $\forall_U xx \exists_U y Fyxx$.³⁶

³⁴When I use universal quantifiers in the text, these should be taken as explicit abbreviations for ‘ $\sim \exists \sim$ ’. Also, as I’ve set things up, both languages actually have *two* quantifiers: a singular one and a plural one. Following Thomas McKay (2006), we could suppose there is really just a plural one and the logical predicate ‘is among’ rather than ‘ \prec ’, and treat the sentences in the text as notational abbreviations for their definitions in these terms.

³⁵Note: these are *not* expressions of L_U , but expressions of our metalanguage to make the axioms easier to read (although they may reflect metaphysical analyses in the overall theory). Given our discussion above, we should probably assume there is another core that has a predicate ‘GP’ it takes as primitive, which is analyzed as suggested in section 3.1.2, and similarly for ‘O’. For simplicity, we’ll set these aside.

³⁶This axiomatization comes from Simons 1987: 37, with a critical amendment from Hovda 2009.

But if U is going to have a chance of being an alternative core to N , it will need one further axiom. It is well-known that claims about ‘atomless gunk’ — objects with proper parts each of which have proper parts — can’t be recovered at all by N .³⁷ To give substantial defection a chance, we’ll suppose that the universalist core theory is ‘atomistic’ — that it insists that everything with a part has a partless part. We do this by adding the axiom

$$(A) \textit{Atomism: } \forall_U x (\exists_U y P y x \supset \exists_U y (P y x \ \& \ \sim \exists_U z P z y))$$

We’ll use U and N for both the core theories and their respective axiomatizations, letting context disambiguate which is meant.

Since these core theories involve plural quantification, we face a question about the logic of their respective languages. Logical consequence is often thought of as either model-theoretic (every model of Δ is a model of ϕ , written ‘ $\Delta \models \phi$ ’) or proof-theoretic (there is a proof of ϕ from Δ , written ‘ $\Delta \vdash \phi$ ’). In first-order theories, a completeness result guarantees that the two are extensionally equivalent, so the choice doesn’t matter. But plural theories are known to be incomplete. Which one should we take as equivalent to \Rightarrow ?

Neither. Or better: we need not take a stand. We start out with a pre-theoretic grip on logical consequence: we don’t know everything there is to know about it, but we know some things. We know enough, for instance, to build ourselves proof theories that are ‘intuitively sound’: if $\Delta \vdash \phi$, then $\Delta \Rightarrow \phi$. And we know enough to build ourselves model theories that are ‘intuitively complete’: if there is a countermodel to an argument, the argument isn’t valid. So if $\Delta \not\models \phi$, then $\Delta \not\vdash \phi$. When we have a completeness theorem for our system, that gives us a ‘squeezing’ argument to show that *both* \vdash and \models are co-extensive with \Rightarrow . But without completeness, we must content ourselves in the knowledge that ‘real’ logical consequence lies somewhere in between these two bounds.³⁸

3.3.2 The Argument

The argument, in its essence, relies on a remarkable fact: although plural languages are in general more expressively powerful than first-order ones, plural languages *without non-logical vocabulary* are precisely as expressive as first-order ones (without non-logical vocabulary). The universalist, with a working dyadic predicate, can make use of this extra expressive power. But since the nihilist essentially throws his dyadic predicate away, his expressive power is limited. As a result, L_U can formulate sentences that L_N cannot capture.

For example, consider the following sentence of L_U :

$$(Inf) \ \exists_U x x \forall_U y (y \prec x x \supset \exists_U z (z \prec x x \ \& \ P z y))$$

³⁷Sider 1993.

³⁸See Field 1991: §1, building on Kreisel 1967.

This sentence says that there are_U some things, each one of which is a proper part of one of the others. Since U makes proper parthood transitive and asymmetric, $U + (\text{Inf})$ will be true only if there are infinitely many things. But it's well known that in classical (atomistic) mereology, there are always 2^n things when there are n atoms; so (Inf) , coupled with U , entails that there are_U infinitely many atoms. Constancy and Recoverability, plus the thought that U and N are somehow just different ways of 'talking about the same mereological atoms', mean that the Nihilist had better have a sentence that, coupled with N , entails that there are_N infinitely many atoms, too, so it can be $t((\text{Inf}))$. But since L_N is no more expressive than a first-order theory with just an identity predicate, it has no such sentence. Thus, N and U can't both be cores of the same metaphysical theory.

More precisely: let ' An ' stand for the counting sentence saying that there are exactly n mereological atoms. Since the defector thinks that U and N can both say the same things about the atoms, the translation between L_U and L_N should take An_N to An_U , and vice versa. (That is, we should have $U \Rightarrow An_U \leftrightarrow t(An_N)$, and similarly for N and U reversed.)

We know that $U + (\text{Inf}) \Rightarrow \sim An_U$ for every n ; as a result, constancy tells us that $N + t((\text{Inf})) \Rightarrow t(\sim An_U)$ for every n , and using Truth-Functional Conservatism and the constraint from the last paragraph, this tells us that $N + t((\text{Inf})) \Rightarrow \sim An_N$ for every n . But the only way $N + \phi \Rightarrow \sim An_N$ for every n is if $N + \phi$ is inconsistent. So $N + t((\text{Inf}))$ is inconsistent, in which case Constancy plus Recoverability tells us that $U + (\text{Inf})$ is inconsistent. But $U + (\text{Inf})$ is consistent; reductio complete. (A more detailed version of the argument can be found in the appendix.)

3.4 Objections and Replies

A substantial defector may complain that we defeated defection only by carefully picking the terms of the debate. I will now argue that other terms aren't as helpful for defection as they may initially appear.

3.4.1 Adding Vocabulary to L_N

We characterized U and N as each having only one non-logical predicate, ' P '. But no plausible metaphysical theory would reduce to this sparse a core: it will need ways to talk about (or analyze) particles being arranged tablewise and so on. So a defector may well insist that if we considered plausible core metaphysical theories we wouldn't be able to run the sort of argument we just ran.

The argument above does indeed fail, as it stands, if L_N and L_U have more non-logical predicates than just ' P '. In particular, if L_N has extra predicates, there is no reason to think we couldn't have some ϕ of L_N , consistent with N , where $N + \phi \Rightarrow \sim An_N$ for every n .

But the above argument is easily adapted to richer languages. If L_U has a finite number of predicates (a plausible supposition), it will have a sentence ψ which says, in effect, that each of these predicates besides ‘P’ is empty. Now consider $\hat{\psi}$, which explicitly restricts the quantifiers in ψ to mereological atoms. We translated atomic counting sentences by swapping subscripts on the grounds that, according to the defector, both theories were talking about atoms (but in different ways), so any sentence ‘just about atoms’ should go over into a similar one in the other core.³⁹ For this reason, $t(\hat{\psi})$ should be (equivalent to something) just like $\hat{\psi}$ except for swapped subscripts. But $U + \hat{\psi} + (\text{Inf}) \Rightarrow \sim An_U$ for every n , and $N + t(\hat{\psi}) + t((\text{Inf})) \not\Rightarrow \sim An_N$ for every n , so we’re back where we started.⁴⁰

3.4.2 Enriching the Logics

Another objection complains about the paucity of logical, rather than non-, resources. If we had allowed various stronger logical apparati in our core theories (the objection goes), the disparity between L_U ’s and L_N ’s expressive power would have gone away.

Whether this is right or not will depend, in large part, on exactly what extra logical resources a defector wants to add. I cannot here canvass every possible extension of (or alternative to) plural logic to determine whether it improves substantial defection’s chances.

But two points are worth making. First, defection fueled by a stronger logic is less threatening than it first appears. The original worry was that the nihilist and the universalist were misled into arguing about whether N or U was the correct metaphysical core because they hadn’t considered the possibility of *both* being core. But the nihilist and universalist weren’t arguing in a vacuum; they had other theoretical commitments in play, including logical ones. If the debate only has a chance of being defective if the background logic is second-order, for instance, and if none of the debaters are happy with second-order logic, then it is hard to see how *they* were misled by failing to consider another possibility. That possibility is only open to those who accept stronger logics than these debaters are happy with.

As it turns out, most parties to the composition debate draw the line at plural quantification. (Peter van Inwagen — who is not a nihilist, but comes close — explicitly endorses plural quantification (1990: 22–28) and explicitly rejects (any other sort of) second-order quantification (2004: 123–

³⁹We should be careful about what counts as being ‘just about atoms’: in some sense, ‘An atom is part of a chair’ is about atoms, but no reasonable t would leave it untouched. The intuitive idea should be clear, though: the nihilist and universalist should agree about how some properties and relations are distributed among the atoms, and t should leave claims about these distributions untouched.

⁴⁰To adapt the argument of the appendix to this setting, simply let χ^\dagger be the result of replacing every non-logical predication in χ with some predication of self-distinctness.

124).) The above arguments show that these parties, at least, haven't missed a conciliatory option.

Second, making the languages more expressive isn't guaranteed to help: as L_N 's power goes up, so does L_U 's, and there is no guarantee that everything sayable in the new, more expressible L_U can also be said in the new L_N .

To illustrate this, consider enriching the logic to full second-order, allowing quantification into predicate positions. (For simplicity, we drop the plural quantifiers and variables altogether and allow bound monadic second-order variables to do their work.) Such languages are thought to be about as expressive as you can get. For instance, for each cardinality κ , there is a sentence $\text{CARD}_\kappa(X^1)$, open in the monadic second-order variable X^1 , that says (more or less) that there are exactly κ X^1 -satisfiers. And for any two monadic variables X^1 and Y^1 , there is a sentence open in these, $X^1 < Y^1$ that says there are more of the Y^1 s than there are X^1 s.⁴¹

Let L_U^2 and L_N^2 be the second-order counterparts of L_U and L_N , and U^2 and N^2 be the universalist and nihilist core theories written in these respective languages.⁴² Now consider a sentence AN_0 which says, in essence, that there is a countable infinity of atoms. Above considerations suggest that $t(\text{AN}_{0U}) \Leftrightarrow \text{AN}_{0N}$. But $U^2 + \text{AN}_{0U}$ entails that there are continuum-many things. And if there are countably many atoms and continuum many things, there will be a further (second-order) question whether there are any things that are strictly more than the atoms and strictly less than the continuum-many things. That is: there will be a question as to whether or not the continuum hypothesis, as formulated about atoms and composites, is true. But this question is not a question that the nihilist can raise after saying that there are countably infinite atoms; for the nihilist, if there are countably many atoms, there are only countably many things.⁴³

Let's be more precise. The language L_U^2 includes the sentence

$$\text{(CH)} \quad \exists_U Y^1 \exists_U Z^1 (\forall_U x (Y^1 x \equiv \text{At}x) \ \& \ \forall_U x (Z^1 x \equiv x = x) \ \& \ \exists_U X^1 (Y^1 < X^1 \ \& \ X^1 < Z^1))$$

(where 'At' is the formula for being an atom, or ' $\sim \exists_U y (Pyx)$ '). This says, in effect, that there are strictly fewer X^1 s than self-identical things (Z^1 s), and strictly fewer atoms (Y^1 s) than X^1 s.

Presumably, $U + \text{AN}_{0U}$ is consistent with (CH) and with its negation. Thus, $N + \text{AN}_{0U}$ had better be consistent with $t(\text{(CH)})$ and with its negation, too. But — since the Nihilist throws away his only non-logical predicate, 'P' — once he has settled the number of atoms, he has settled everything there is

⁴¹See Shapiro 1991: 101–106 for definitions of these and other related formulae.

⁴²The axiomatization of N^2 just is N ; that of U^2 is just like U but for swapping plural and second-order quantification in (UC).

⁴³Thanks here to Brian Weatherson

to settle. That is, for any ϕ that settles the cardinality of atoms, there are no incompatible sentences ψ and χ that are both consistent with $N + \phi$.⁴⁴ So $N + \text{AN}_{0U}$ cannot be consistent with both $t((\text{CH}))$ and its negation.

The substantial defector can resist this argument, but at a cost. The argument relies on two consistency claims:

- (i) $U + \text{AN}_{0U} \not\Rightarrow (\text{CH})$
- (ii) $U + \text{AN}_{0U} \not\Rightarrow \sim(\text{CH})$

These could be rejected. After all, the standard models for second-order logic rely on set theory. If the continuum hypothesis (the one about sets) is in fact *true*, the objection goes, then deny (i); if false, (ii).

If we equate \Rightarrow with \models , we will be forced to do just that. Fortunately, though, we were careful *not* to make this equation. Existence of a countermodel shows failure of consequence, but (without a complete proof procedure) absence of a countermodel might not show consequence. One advantage of our caution is that we can deny that the continuum hypothesis (or things very nearly in its neighborhood) are logical truths. And this seems like a real advantage: it is especially difficult to think of the continuum hypothesis, of all things, as a *logical* truth. A defector can demur, of course. And if he does, (CH) is easy to translate: if it is a consequence of $U + \text{AN}_{0U}$, for instance, it goes to $\text{AN}_{0N} \ \& \ \top$.⁴⁵ But he does so at a price: the price of insisting that the continuum hypothesis is a logical truth.

4 CONCLUSION

Defection usually occurs in response to the irritation described in §1.1. But we have seen how to soothe that itch without scratching, by taking seriously the thought that ontological questions ask after the unanalyzable things, the *substances*. And while the apparatus involved leaves room for the thought that debates about what the substances are like might themselves be defective, we have seen that the thought cannot be maintained in what looks like the best-case scenario for defection. We have reason, then, to think debates about the substances themselves will in general not be defective.

⁴⁴In N_L^2 , that is. If N_L^2 has other non-logical predicates, there will be such ψ and χ ; but the argument can be re-created by appeal to $\hat{\psi}$ -like sentences.

⁴⁵Why the conjunction? Because (CH), as we wrote it, entails that there are countably many atoms, and so we want its translation to be false if there aren't.

APPENDIX

A.1 Proof of Truth-Functional Conservatism

It suffices to prove the equivalence for a truth-functionally complete set of connectives. We'll prove:

$$\text{a) } A \Rightarrow t(\sim\phi) \leftrightarrow \sim t(\phi)$$

$$\text{b) } A \Rightarrow t(\phi \ \& \ \psi) \leftrightarrow t(\phi) \ \& \ t(\psi)$$

We'll use A' for the axiomatization of the other core. Start with part (b). We demonstrated the right-to-left direction in the text. Left-to-right: $A' + \phi + \psi \Rightarrow \phi \ \& \ \psi$, so $A + t(\phi) + t(\psi) \Rightarrow t(\phi \ \& \ \psi)$, so $A + t(\phi) \ \& \ t(\psi) \Rightarrow t(\phi \ \& \ \psi)$, which means $A \Rightarrow t(\phi) \ \& \ t(\psi) \rightarrow t(\phi \ \& \ \psi)$.

Part (a), left-to-right: $A' + \phi + \sim\phi \Rightarrow \perp$, so $A + t(\phi) + t(\sim\psi) \Rightarrow \perp$, so $A + t(\sim\phi) \Rightarrow \sim t(\phi)$ and thus $A \Rightarrow t(\sim\phi) \rightarrow \sim t(\phi)$. Right to left: suppose for reductio that $A + \sim t(\phi) \not\Rightarrow t(\sim\phi)$. Then $A + \sim t(\phi) + \sim t(\sim\phi) \not\Rightarrow \perp$. So $A' + t(\sim t(\phi)) + t(\sim t(\sim\phi)) \not\Rightarrow \perp$. But by the left-to-right direction of (a), $A' + \sim t(t(\phi)) + \sim t(t(\sim\phi)) \not\Rightarrow \perp$, and so — substituting equivalents via recoverability — $A' + \sim\phi + \sim\sim\phi \not\Rightarrow \perp$. Contradiction. \square

The right-to-left direction of (a) is the only place where recoverability is used. In a multiple-conclusion setting, recoverability can be dropped altogether: we argue $A' \Rightarrow \phi + \sim\phi$, so $A \Rightarrow t(\phi) + t(\sim\phi)$, so $A + \sim t(\phi) \Rightarrow t(\sim\phi)$. (In this setting, $\Gamma \Rightarrow \Delta$ means, roughly, that it's a logical consequence of Γ that at least one member of Δ is true; see Restall 2005 for a more nuanced treatment).⁴⁶

A.2 The Argument of §3.3.2 Expanded

A.2.1 The Setup

Let ' En ' designate the counting sentence that says there are exactly n things. If Φ^n is the sentence open in x_1, \dots, x_n which conjoins, for each x_i and x_j , $\lceil x_i \neq x_j \rceil$, and Ψ^n be the sentence open in these variables plus one more, y , which disjoins $\lceil x_i = y \rceil$ for each x_i , then we can define ' En ' as shorthand for

$$\exists x_1 \dots \exists x_n (\Phi^n \ \& \ \forall y (\Psi^n))$$

Likewise, where ' $At\alpha$ ' abbreviates $\lceil \sim \exists z (Pz\alpha) \rceil$, let ' An ' be shorthand for

$$\exists x_1 \dots \exists x_n (Atx_1 \ \& \ \dots \ \& \ Atx_n \ \& \ \Phi^n \ \& \ \forall y (Aty \supset \Psi^n))$$

⁴⁶Thanks here to Robbie Williams.

These subscripted with ‘ N ’ or ‘ U ’ represents subscripting all of their respective quantifiers the same way. Finally, where ϕ is any sentence of L_N , let ϕ^\dagger be the result of replacing every instance of $\lceil \text{P}\alpha\beta \rceil$ with $\lceil \alpha \neq \alpha \rceil$. Note that applying \dagger to a truth-functional compound is the same as applying \dagger to each of its parts.

The argument relies on four theorems:

Theorem 1: $U + (\text{Inf}) \Rightarrow \sim \text{An}_U$, for all n .

Theorem 2: For any ϕ of L_N , $N \Rightarrow \phi$ iff $\Rightarrow \phi^\dagger$.

Theorem 3: $\text{En}_N \Leftrightarrow \text{An}_N^\dagger$.

Theorem 4: If ϕ contains only logical vocabulary and is consistent, it’s not the case that $\phi \Rightarrow \sim \text{En}_N$ for all n .

First we’ll give the argument from the theorems; then proofs of the theorems themselves.

A.2.2 The Argument

Suppose for reductio that N and U are cores of the same theory. Then there is a logically constant and recoverable translation t between L_N and L_U . Since the theories ‘say the same things about the atoms’, $t(\text{An}_N) \Leftrightarrow \text{An}_U$.

For all n , since $U + (\text{Inf}) \Rightarrow \sim \text{An}_U$ by Theorem 1, $N + t((\text{Inf})) \Rightarrow \sim t(\text{An}_U)$ by Constancy and Truth-Functional Conservatism, and so $N + t((\text{Inf})) \Rightarrow \sim \text{An}_N$. So $N \Rightarrow t((\text{Inf})) \supset \sim \text{An}_N$, in which case $\Rightarrow t((\text{Inf}))^\dagger \supset \sim \text{An}_N^\dagger$ by Theorem 2, and so $\Rightarrow t((\text{Inf}))^\dagger \supset \sim \text{En}_N$ by Theorem 3. And this holds for all n . But since $t((\text{Inf}))^\dagger$ contains only logical vocabulary, it must be inconsistent by Theorem 4. So $\Rightarrow t((\text{Inf}))^\dagger \supset \perp$, so $N \Rightarrow t((\text{Inf})) \supset \perp$ by Theorem 2, so $U \Rightarrow (\text{Inf}) \supset \perp$ by Recoverability, Constancy, etc. In other words, $U + (\text{Inf})$ is inconsistent. But $U + (\text{Inf})$ is consistent; reductio complete. \square

A.2.3 Proofs of Theorems

Given the discussion of \models , \vdash , and \Rightarrow in §§3.3.1 and 3.4.2, we need to tread carefully. To prove something of the form $\phi \Rightarrow \psi$, we show $\phi \vdash \psi$; to prove $\phi \not\Rightarrow \psi$, we show $\phi \not\vdash \psi$.

Theorems 2 and 4: These theorems rely on a metalogical result: if ϕ is any sentence of monadic second-order logic that contains only logical vocabulary, there is a set of transformations that turn it into an equivalent sentence ψ of first-order logic using only the identity predicate (Ackermann 1954: 47). As a corollary, if ϕ is consistent, then ϕ has finite models. In this case, $\phi \not\vdash \sim \text{En}$ for at least some n , and so it’s not the case that $\phi \Rightarrow \text{En}$ for all n . Since, as is

well known, monadic second-order logic and plural logic can each interpret the other (Boolos 1985), this also holds for plural ϕ , and Theorem 4 follows.

As another corollary, there is a complete proof procedure for plural logic without any non-logical vocabulary. That is, if ϕ is a sentence of plural logic with only logical vocabulary, $\models \phi$ iff $\vdash \phi$; we can use this to argue, Kreisel-style, that model- and proof-theoretic consequence coincide with logical consequence here. We then prove Theorem 2 as follows:

For every first-order model of N and variable assignment, Pxy is false on that model and variable assignment. So $N \models Pxy \equiv x \neq x$. Since the formulae are first-order, we conclude via completeness that $N \vdash Pxy \equiv x \neq x$. Since ϕ^\dagger is gotten from ϕ by replacements of these two, general substitutivity results tell us that $N \vdash \phi \equiv \phi^\dagger$, and so $\vdash (N \supset \phi) \equiv (N \supset \phi^\dagger)$.⁴⁷ Thus, $\Rightarrow N \supset \phi$ iff $\Rightarrow N \supset \phi^\dagger$.

Suppose ψ has only logical vocabulary and is false on some models. Then there are also models on which $N \supset \psi$ is false. Here's why: if ψ has a model, then it has a model on a language with no non-logical predicates. Call that model \mathcal{M} ; let \mathcal{M}' be just like it, except that it also interprets the non-logical predicate 'P', and interprets it as empty. Then \mathcal{M}' is a model of N , and so a countermodel to $N \supset \psi$. Thus, $\not\models N \supset \psi$. So, if $\Rightarrow N \supset \psi$, $N \supset \psi$ has no countermodels. Thus ψ also has no countermodels, so $\models \psi$. But, as noted above, this holds in a complete fragment of plural logic, so $\vdash \psi$, and therefore $\Rightarrow \psi$.

Thus, if $N \Rightarrow \phi^\dagger$, $\Rightarrow \phi^\dagger$. Conversely, if $\Rightarrow \phi^\dagger$, then of course $\Rightarrow N \supset \phi^\dagger$. Putting these two together with the last line two paragraphs ago, we have $N \Rightarrow \phi$ iff $\Rightarrow \phi^\dagger$. \square

Theorem 3: Applying \dagger to open sentences $A\alpha$ turns them into $\ulcorner \sim \exists z(z = z) \urcorner$, and so the sentence An^\dagger becomes

$$\exists x_1 \dots \exists x_n (\bigwedge_n [\sim \exists z(z \neq z)] \ \& \ \Phi^n \ \& \ \forall y (\sim \exists z(z \neq z) \supset \Psi^n))$$

Both En and An^\dagger are first order sentences. Moreover, since $\sim \exists z(z \neq z)$ is true on all models, it's easy to see that En and An^\dagger are true on exactly the same models. So $\models En \equiv An^\dagger$. Since these are first-order sentences, we have $\vdash En \equiv An^\dagger$. Thus $\Rightarrow En \equiv An^\dagger$, which means $En \Leftrightarrow An^\dagger$. \square

Theorem 1: Let U_{FO} be first-order classical mereology, the result of replacing (UC) from U with every instance of the formula

$$(UC_{FO}) \ \exists_U x \phi_x \supset \exists_U y (\forall_U z (\phi_z \supset GPzy) \ \& \ \forall_U z (GPzy \supset \exists_U w (\phi_w \ \& \ Owx)))$$

with ϕ_α a formula open only in α .

Let \star be the claim

⁴⁷Note that N is axiomatized with just one axiom; I'm also using 'N' as a name for that axiom.

$$(\star) \exists_U x Fx \ \& \ \forall_U y (Fy \supset \exists_U z (Fz \ \& \ Pzy))$$

This says, in essence, that there are some F s, and every F has another F as a part. In standard models of mereology, F has an infinitely large extension, which means that these models are infinitely large. Since first-order logic is finitely categorical, U_{FO} has no finite non-standard models; so $U_{FO} + \star$ has no finite models. (All of its models are either standard, in which case they're infinite thanks to the nature of boolean algebras, or they're non-standard, in which case they're infinite because they're non-standard.) Furthermore, every model of U_{FO} on which An_U is true for finite n is a finite (and hence standard) model. So $U_{FO} + \star \models \sim An_U$ for all natural numbers n . Since this is first-order, we have $U_{FO} + \star \vdash \sim An_U$.

Let P be the first-order proof of $\sim An_U$ from $U_{FO} + \star$. If we replace every instance of $F\alpha$ in the proof with $\alpha \prec aa$, we get a proof of $\sim An_U$ from $U_{FO} + \star\star$, where

$$\star\star = \exists_U x (x \prec aa) \ \& \ \forall_U y (y \prec aa \supset \exists_U z (z \prec aa \ \& \ Pzy))$$

Prefix the following lines to this proof:

- i) $\exists_U x x \forall_U y (y \prec x x \supset \exists_U z (z \prec x x \ \& \ Pzy))$ (Inf)
- ii) $\forall_U y (y \prec aa \supset \exists_U z (z \prec aa \ \& \ Pzy))$ existential instantiation
- iii) $\exists_U x (x \prec aa)$ axiom (plural logic)
- iv) $\exists_U x (x \prec aa) \ \& \ \forall_U y (y \prec aa \supset \exists_U z (z \prec aa \ \& \ Pzy))$ ii, iii

Since ' aa ' doesn't occur in $\sim An_U$, this use of existential instantiation doesn't keep the resulting sequence from being a proof; so we have $U_{FO} + (\text{Inf}) \vdash \sim An_U$. If U can prove all of the sentences of U_{FO} , we'll be done.

But it can. U and U_{FO} differ only on (UC) and (UC_{FO}). But (UC) can be used to derive every instance of (UC_{FO}) by use of the plural comprehension schema:

$$(\text{PCS}) \exists x \phi_x \supset \exists y y \forall x (x \prec y y \equiv \phi_x)$$

So $U + (\text{Inf}) \vdash \sim An_U$, in which case $U + (\text{Inf}) \Rightarrow \sim An_U$. □

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