The Barest Flutter of the Smallest Leaf: Understanding Material Plenitude

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> The barest flutter of the smallest leaf creates and destroys infinitely many things, and ordinary reality suffers a sort of "explosion."
> —Ernest Sosa, "Existential Relativity"

We start small: although the ring on my finger coincides with the quantity of metal that makes it up, the metal can survive things that my ring cannot. Unlike my ring, the quantity of metal can survive being recast into a coin, an earring, or a part of a computer chip. The ring, on the other hand, can survive having portions removed for resizing, while the very same quantity of metal cannot.

These differences—in what changes the ring and hunk of metal can survive—are differences in their modal properties. The ring has its shape *essentially* (it must have that shape if it exists at all), while the

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quantity of metal has that shape only *accidentally* (it still might have existed with a different shape).[1]

This is one of many familiar examples that motivate *pluralism* about material constitution: the view that there might be distinct coincident things that differ in their modal properties. I, like other pluralists, think that wherever my ring is, there are *at least* two material objects. Pluralism is among the most popular responses to the paradoxes of material constitution, but may not be as innocent as it seems at first. Having distinguished the ring from the metal, it seems to many that we lack principled grounds for not recognizing further distinctions between coincidents. The resulting picture is radical: the material world is in some sense *full to the brim* with coincident objects.[2]

According to defenders of *material plenitude*, in addition to the ring and the metal there is something that would be destroyed if this engraving were to wear off completely, something else that couldn't have been given to me by anyone but you, and something further that could survive being recast into an earring but not into a coin. (Perhaps: a signet ring, a friendship token, a piece of heirloom jewelry.)[3] For any change at all, the thought goes, there are coincidents that differ with respect to whether they survive it. Sosa's fluttering leaf destroys multitudes.[4]

My aim in this article is to develop and defend a novel formulation of material plenitude. As I'll argue, it turns out to be extraordinarily tricky to pin down a coherent statement of the view. Straightforward attempts to do so are either inconsistent or fail to adequately capture

1. I am using these terms stipulatively as shorthand for certain familiar modal notions: x has F *essentially* iff necessarily, if x exists, Fx. Similarly, x has F *accidentally* iff Fx, but possibly x exists and is not F. See Fine 1994 for reasons to think that these modal notions don't capture everything we might want to capture about the metaphysics of essence and accident.

2. A note about coincidence: for reasons that will become clear in section 2, I hope to remain neutral throughout on how exactly to define "coincidence," and, in particular, on whether by "coincidence" we mean mere *spatial* coincidence (sharing of location) or *material* coincidence (sharing of some or all material parts). Although coincidence is central to the views I'll be discussing, the issues I raise will arise in some form whichever notion we invoke.

3. Nothing hangs on these suggestions. Strangeness is no barrier to existence on the plenitude-lover's picture (e.g., there is also something coincident with my ring that cannot survive my computer updating its operating system), but it is still worth noting that the modal properties of familiar objects are sometimes stranger than we recognize.

4. This image from Sosa 1999 is referenced in the epigraph above, and is also the inspiration for the title of this article.

the target idea. Making progress requires us to engage in more delicate metaphysics than we might have expected and, along the way, reveals substantive constraints on the material world.

Even armed with only the rough gloss of plenitude I've given so far, it is clear that the picture is ontologically decadent to an extreme. However, its proponents argue that this decadence is justified (even inevitable!) when we take seriously worries about arbitrariness and anthropocentrism in our metaphysical theorizing. Why think that there is something coincident with the quantity of metal on my finger that can't survive change of shape, but deny that there is something further that can't survive change of location? The cases seem (at least to the plenitude-lover) to be metaphysically on a par, and differ only in that we ordinarily recognize objects of the first sort but not the second. But it seems that after we've bought seriously into pluralism, we should be suspicious of those who, as Stephen Yablo (1987: 307) puts it, "insist on the credentials of the things we recognize against those which others do, or might."[5]

The force of anti-arbitrariness considerations has compelled many philosophers to endorse plenitude, despite its radicalism. Plenitude has been defended in some form by, among others, Stephen Yablo (1987), Ernest Sosa (1999, 178), Kit Fine (1999), John Hawthorne (2006), Sarah-Jane Leslie (2011), Ross Inman (2014), Mark Jago (2016), and Irem Kurtsal (n.d.).[6] Even opponents of plenitude have engaged with it as a serious contender in debates about material object metaphysics (see, e.g., Bennett 2004 and Korman 2015).

Plenitude not only promises to deliver a response to the paradoxes of material constitution that avoids intolerable arbitrariness, but has also been put to work in other ways: Karen Bennett (2004) argues that pluralists must endorse plenitude not just to avoid arbitrariness, but to have an adequate answer to the grounding problem. Sarah-Jane Leslie (2011) argues that material plenitude allows us to dissolve a family of

5. This kind of *argument from arbitrariness* for permissive ontologies is extremely pervasive. See for example Sosa 1987: 178; Sosa 1999: 178; van Inwagen 1990: 126; Sider 2001: 156; Hawthorne 2006: esp. 109; and van Cleve 2008; as well as Thomasson 2015: 212–15. For resistance to this line of argument, see Korman 2015: chap. 8 and Fairchild and Hawthorne 2018 for further discussion.

6. The more radically permissivist views developed in Thomasson 2015 and Eklund 2008 will also yield something like the kind of material plenitude I discuss here, although the motivations in each case are somewhat different.

"paradoxes of essentialism" involving "tolerant" essences. Shamik Dasgupta (2016) proposes a solution to Parfit's Non-Identity problem in ethics that relies crucially on material plenitude. Theodore Sider (2017) suggests that plenitude might provide the right framework for theorizing about Haslangarian social structures. But despite its importance, plenitude isn't well understood beyond its slogan form.

The target idea implicit in much of the discussion is something very much like the picture Dasgupta (2016: 547) calls "unlimited essentialism":

> On this view, there is a dazzlingly large number of distinct entities coincident with Statue, one for each subset of its non-modal properties! There is an entity that is essentially in my office, which is destroyed when I take it elsewhere; an entity with its value essentially, which is destroyed when its value rises; an entity with its position relative to Saggitarius essentially, which is destroyed as we rotate around the sun; and so on.

The thought looks deceptively simple, but it is harder to pin down a precise formulation of plenitude based on this target idea than we might expect. For example, one thesis in the neighborhood of the passage above is:

> **Exact Essence.** For any subset of *o*'s nonmodal properties, there is something coincident with *o* that has exactly those properties essentially.

But Exact Essence has easy counterexamples. For example, the statue Statue has the nonmodal property *being statue-shaped*. But nothing has that as its *only* essential property. Anything that is essentially statue-shaped is also essentially statue-shaped or green. (Recall that essential properties, in the sense I intend, are closed under entailment.) Likewise, any object *x* has the property *being identical to x* essentially. Still, we also want to distinguish plenitude from another important idea:

> **Just the Essentials.** For any subset of *o*'s nonmodal properties, there is something coincident with *o* that has those properties essentially.

Just the Essentials, unlike Exact Essence, *merely* requires that every subset of *o*'s nonmodal properties is had essentially by *something* coincident with it. But that is a low ontological bar! Suppose there could be a world where every object is a "modal minimum"—an object that has all of its (nonmodal) properties essentially. Such a world satisfies Just the Essentials, but is a far cry from a modally plenitudinous world. So (albeit for different reasons) Just the Essentials also misses the mark as an attempt to capture the target idea behind plenitude.

We can make things a little more precise by introducing the ideology of "modal profiles." Very roughly, an object's *modal profile* specifies the changes it can and cannot survive. We'll say that a modal profile M *based on* a set of properties S is a partition of S into two subsets E and A. An object has M if it has every property in E essentially and every property in A accidentally.[7] Dasgupta's target in the passage above, then, is something like:

> **Nonmodal Plenitude.** For any material object o and any modal profile M based on all of o's nonmodal properties, there is something coincident with o that has M.

Nonmodal Plenitude seems initially to capture a lot of what we wanted from the target idea. However, challenges remain. I think these challenges are most helpfully presented as two problems, though, as we'll see, they are very tightly connected.

The first is: on pain of incoherence, any adequate formulation of plenitude will require *some* restriction to keep troublesome properties—the "bad eggs"—out of the "bases" of modal profiles. That is, there must be some restriction on the membership of the set S of properties partitioned by M. Nonmodal Plenitude, for example, restricts the bases of modal profiles to *nonmodal* properties, thereby avoiding the result that (for example) there is something coincident with my ring that is accidentally *essentially shaped like so*.[8] In section 1, however, I show that this restriction fails and consider a more refined proposal drawn from Bennett 2004. I argue that this too runs into trouble, and propose a very different sort of strategy. I'll call this challenge the *bad eggs problem*.

However, we face a further challenge even after we've answered the bad eggs problem. The formulation of Nonmodal Plenitude above requires that there be an object corresponding to *every* partition of the properties in S (whatever they are). But there are some partitions of apparently innocent properties that yield impossible modal profiles;

7. This conception of modal profiles broadly follows the strategy in Yablo 1987 and Bennett 2004. Hawthorne 2006 offers another way of understanding modal profiles: as partial functions from worlds to filled regions of space-time. It is an interesting further question how these two conceptions of modal profiles (and the resulting varieties of plenitude) might come apart.

8. Given that metaphysical possibility is transitive, if something is *essentially F*, it is *essentially essentially F*.

for example, nothing has *being red* as an essential property and *being colored* as an accidental property. Partitions like this correspond to modal profiles that are in some sense "inconsistent"; the instantiation of these profiles is ruled out already on general metaphysical grounds. So, any adequate formulation of plenitude will have to solve *the consistency problem* by identifying a minimal restriction to consistent modal profiles.[9]

Both problems have been acknowledged in some form by many philosophers writing on plenitude. For example, Yablo (1987) discusses a version of the bad eggs problem at length, and Bennett (2004) presses something like the consistency problem as the final outstanding worry for plenitudinous pluralism.[10] Both also acknowledge the stakes of giving a satisfying response: for plenitude to retain any of its initial appeal, the resulting constraints on modal profiles will have to be more minimal than the restrictions imposed by more conservative metaphysicians.[11]

Although these challenges have been recognized in the literature, my first aim in this article is to suggest that we have nonetheless failed to appreciate the depth and consequences of the obstacles facing *any* attempt to formulate a viable version of plenitude. In sections 1 and 2, I develop the bad eggs problem and argue that the strategy of characterizing the bases of modal profiles by appeal to taxonomical distinctions between properties (e.g., the modal/nonmodal distinction) won't work. I then propose a solution that relies on a purely structural observation about modal profiles. In section 3, I argue that the consistency problem runs deeper than standard presentations suggest and raise trouble for what I take to be the most promising version of plenitude suggested by existing literature. Finally, in section 4, I turn to my second aim: to develop and defend a version of plenitude capable of addressing both challenges. As I argue there and further in section 5, these considerations lead us to the view I call *global plenitude*.

9. Note that here I am using "consistency" in a nonstandard way. Some of the problematic profiles are not *logically* inconsistent but rather in some sense *metaphysically* inconsistent.

10. See, for example, Yablo 1987: 296–300; and Bennett 2004: 357.

11. For example, Bennett contrasts the *plenitudinous bazillion-thinger*, who thinks that there are very many consistent modal profiles, with the so-called *plenitudinous two-thinger*, who claims to accept the letter of plenitude but holds that there are very few possible modal profiles (e.g., the ones corresponding to the objects we ordinarily recognize). Part of the challenge of the consistency problem as I understand it is ruling out views like plenitudinous two-thinger-ism.

The idea behind plenitude suggests that the resulting picture of the material world will be radically full but ultimately straightforward—there seems to be little subtlety in an overflowing ontology. However, my third and ultimate goal in this article is to show that global plenitude carries with it a rich and complex picture of the material world—far richer than anyone seems to have expected. For this reason, many of the proposed applications of plenitude may require a more delicate touch than we thought. Many of the arguments I consider here also show that we have to be extremely careful what *other* principles of abundance we associate with plenitude—I return to this in section 6. Moreover, since we are led to global plenitude by attempts to give minimal responses to very general problems for plenitude, this discussion reveals not only an attractive formulation of the target idea, but also substantive constraints on any adequate formulation of plenitude.

1. Bad Eggs

Central to the plenitudinous picture is the idea that many of an object's properties are had essentially by something coincident with it. For example, for nearly every change, there is something hereabouts that cannot survive it: something coincident with me is essentially sitting, and destroyed when I stand; something is essentially typing, and destroyed when I pause. Plenitude similarly purports to guarantee that nearly every change is also *survived* by some of my coincidents. Very many of my properties are had accidentally by something coincident with me: something here is only accidentally living, and survives my last breath; something else has its origins accidentally and might have had different parents than me. But this can't go for all properties: certain properties can't be had essentially and others can't be had accidentally, even by the permissive lights of the plenitude-lover.

For example, consider modal properties like *being essentially statue-shaped* and *accidentally wearing a scarf.* Nothing can be accidentally essentially statue-shaped, and nothing can be essentially accidentally scarfed. On the first, as observed above, given that metaphysical possibility is transitive, no thing has any of its essential properties merely accidentally. The argument for the second observation is more subtle, but notice that for o to essentially be *accidentally* F would be for o to be *accidentally* F wherever it exists. Since being *accidentally* F entails being F, o should therefore be F wherever it exists. But being *accidentally* F also entails possibly existing while failing to be *F.* So *o* must be possibly not *F* and not possibly not *F*—a contradiction.[12]

These properties seem to cause trouble for plenitude because coincidents can't *freely vary* with respect to their modal status. By way of illustration, compare an obviously false formulation of plenitude that invokes no property restriction at all:

> **Naive Plenitude.** For any material object *o* and any modal profile *M* based on all of *o*'s properties, there is something coincident with *o* that has *M.*

Naive Plenitude entails that for *any* property whatsoever, coincidents can vary with respect to its modal status. That is, for any property *F* of *o*, there is something coincident with *o* that has *F* accidentally, and something coincident with *o* that has *F* essentially. But, as the cases above reveal, this is incoherent for modal properties like *being essentially F* and *being accidentally G.* Nonmodal Plenitude does better than Naive Plenitude on this count, by restricting the properties in the bases of modal profiles to only the *non*modal properties.

Unfortunately for Nonmodal Plenitude, some "bad eggs" aren't obviously modal properties, and so aren't uncontentiously ruled out by this restriction. Consider identity properties like *being Statue.* This isn't a paradigmatic *modal* property (at least on a superficial gloss of what it is for a property to be modal),[13] but if it is allowed into a modal profile based on Statue, Nonmodal Plenitude is straightforwardly false. Nothing with the property *being Statue* differs modally from Statue in any way. Similarly, properties like *being human* aren't clearly modal properties but nonetheless have modal import. For example, being human might require *being essentially human.* If that's right, nothing can be *accidentally* human, since (as before) nothing can be accidentally essentially human. And so, just like with modal properties, we can't consistently suppose that coincidents freely vary with respect to the modal status of these properties.[14]

12. See Spencer 2017 for an argument modeled on Fitch's Paradox of Knowability that generalizes this last kind of case. Notice that other properties cause very similar problems: *being actually seated*, *possibly redheaded*, and so on.

13. One related difficulty with this response to the bad eggs problem is that it requires a conception of properties as more fine-grained than functions from worlds to sets of individuals. On the coarse-grained picture, there is no helpful distinction between "modal" and "nonmodal" properties.

14. The staunch defender of Nonmodal Plenitude may insist that the characterization of modal properties implicit here is too narrow-minded, and that we should

In the following section, I consider a more refined proposal drawn from a suggestion in Bennett 2004. This proposal expands the class of restricted properties to so-called "sortalish" properties, thus excluding kind and sortal properties as well as properties that *depend on* modal, kind, and sortal properties. Ultimately, I argue that this distinction fails to avoid a further family of counterexamples and suggest that this should make us pessimistic about the general strategy behind both responses to the bad eggs problem. In section 2, I turn to a different approach: rather than identifying the bad eggs by relying on a metaphysically contentious taxonomy of properties, we might instead appeal to a purely structural observation about the role the "*good* eggs" play in the target idea.

1.1. Another Taxonomical Strategy: Sortalish Properties

Recent appeals to nonmodal plenitude trace back to a version of plenitude proposed by Bennett in "Spatiotemporal Coincidence and the Grounding Problem." There, she invokes a restriction to what she calls "non-sortalish" properties: "The story is really very simple. It is this: every region of spacetime that contains an object at all contains a distinct object for every possible way of distributing 'essential' and 'accidental' over the non-sortalish properties actually instantiated there" (Bennett 2004: 354). The restriction to "non-sortalish" properties excludes "(i) persistence conditions, particularly modal properties like being essentially shaped about like so, (ii) kind or sortal properties, and (iii) properties that things have partially in virtue of their instantiation of properties in categories (i) or (ii)" (Bennett 2004: 341). Bennett herself notes that this is only intended as a rough gloss of what it is for a property to be "sortalish," and her initial aim in introducing the term is importantly different than the use we'll now put it to.[15] Still, it will be informative for us to first consider the proposal at face value.

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think of anything with a modal entailment as a modal property. On that picture, identity properties and kind properties *are* genuinely modal. The worries I raise for Bennett's *non-sortalish* proposal below apply to this suggestion as well.

15. Bennett's reason for introducing the "sortalish"/"non-sortalish" distinction was to characterize the grounding problem more precisely, capturing the observation that the grounding problem concerns *all* of the alleged differences between coincident objects, not just the modal differences. Though this is closely related to the bad eggs problem in ways that will become clear in the next section, it is important to note that Bennett isn't explicitly taking on the same question we're now concerned with.

Restricting the bases of modal profiles to include only non-sortalish properties seems to improve in many ways on Nonmodal Plenitude. For example, Bennett-style plenitude accommodates the worries above about properties like *being human*, which is plausibly a kind or sortal property. But other problem cases are harder to pin down: consider as a warm-up the property *being Madeline and wearing a yellow hat*. This is neither a modal nor a sortal property, so it might be initially tempting to say that there is something coincident with Madeline that has the property *being Madeline and wearing a yellow hat* essentially. But since Madeline can survive removal of her hat, nothing essentially hat-wearing can be identical to her, and so nothing can have that modal profile.

One response is, of course, that the property *being Madeline and wearing a yellow hat* partly depends on Madeline's possession of certain modal or sortal properties and so counts as "sortalish" by Bennett's third condition. But what seems to be doing the work in this case is not the modal import of the property (as with the cases above). Rather, it is that the property can't be had *at all* by anything distinct from Madeline.

This problem seems to be much more general. For example, consider a property like *being God's favorite thing*. This isn't an identity property, but, nonetheless, only one thing can be God's favorite, and so there cannot be coincident objects that differ with respect to whether they have that property essentially or accidentally (since there cannot be distinct things that have it at all).[16] Something similar goes for many other properties: for example, *being one of Maria's fifteen favorite things*. On the face of it, this is a non-sortalish property. Suppose that Fido is one of Maria's fifteen favorite things. Any modal profile based on Fido's non-sortalish properties would require the object with that profile to have the property *being one of Maria's fifteen favorite things*, and so a non-sortalish version of plenitude threatens to deliver the unacceptable result that (many) more than fifteen things share the property *being one of Maria's fifteen favorite things*. Call any property like this a "capped" property.

"Capped" properties reveal that the bad eggs challenge for plenitude isn't *just* about determining which properties can consistently be had either essentially or accidentally. In principle, capped properties can vary in this respect: perhaps one of Maria's favorite things is essentially so, while another could live on among the less favored. Capped properties constrain the modal profiles of objects that have them in a different way:

16. Perhaps also God's favor doesn't depend on any modal or sortal properties of the object.

if something is one of Maria's fifteen favorite things, it must have one of fifteen modal profiles.

Of course, it is always open to the devoted defender of the non-sortalish strategy to argue that any such property is in fact implicitly modal, or sortal, or depends in some way on modal and sortal properties. I am pessimistic that this will be successful for a class of problem cases as heterogeneous as this. More worryingly, it seems largely orthogonal to making progress on understanding material plenitude. The intelligibility of plenitude doesn't (or shouldn't) hinge on having the distinction between non-sortalish and sortalish properties precisely in hand.

Where does this leave us? We need a characterization of the properties to be excluded from the bases of modal profiles that is informative enough to make progress understanding the target view. We might proceed as we have so far—searching for the right taxonomical line in fits and starts—but this doesn't strike me as especially promising. Thankfully, we can make significant progress without giving a precise explication of which properties are the "bad eggs." Instead, we can work with a purely structural observation about the target idea. Having done so, we'll see why we should be pessimistic about identifying *all* of the troublesome properties before we have a better handle on other features of plenitude.

2. A Structural Solution: Neutral Properties

The taxonomical strategy, though tempting, faces serious challenges. The problems we've encountered so far should at least make us pessimistic about the prospects of identifying some independent similarity all of the troublesome properties share. Instead, we might try a different sort of approach entirely. Rather than relying on an antecedent characterization of the *bad* eggs, we can pick out the *good* eggs by appeal to the structural role they're meant to play in plenitude.

Return briefly to the initial picture. Plenitude is motivated in part by the broad-strokes observation that coincident objects share their circumstances, but differ with respect to whether they can survive changes to those circumstances.[17] The statue and the clay have the same shape, but differ with respect to whether they have it essentially. The ring and the hunk of metal are made up of the same matter, but differ with respect to whether they are made up of that very matter essentially. We captured this

17. Or, more carefully: they differ with respect to whether they could exist under other circumstances.

idea at the outset with the help of a bit of technical terminology, describing coincidents as instantiating different "modal profiles" that are "based on" a set of shared properties.

With this in mind, we can capitalize on a purely structural observation about the role of the "good eggs" in our formulation of plenitude: they're properties that are shared by coincident objects. Many of the troublesome properties we identified in previous sections were troublesome precisely because we couldn't coherently suppose that an abundance of coincident objects shared them.[18]

Let us then focus on exactly the properties that are completely *neutral* with respect to coincidence:

> A property F is *neutral* iff necessarily, for all x and y, if x and y coincide, Fx iff Fy.

If we help ourselves to some uncontroversial facts about coincidence, we can already begin to see how this will help. On any plausible definition of coincidence, coincident objects must share their shape and location properties, but clearly *won't* share identity or capped properties.[19] More contentiously, by the plenitude-lover's lights, many modal and "sortal" properties won't be shared by coincident objects: *being human*, *being essentially shaped like so*, and *being accidentally located at r* won't be neutral.[20]

Much more needs to be said here (especially on the last point) but it will helpful to have the corresponding proposal in hand first. Here is the most straightforward formulation of plenitude in light of the current suggestion:

18. In some sense, this is exactly how Bennett's appeal to non-sortalish properties was meant to function in the context of her discussion of the grounding problem: to pick out the properties shared by coincidents. Happily for our purposes we can jettison the elusive distinctions and work only with the structural characterization.

19. Thanks to an anonymous reviewer for pointing out that it is illuminating to note that if genuine coincidence is impossible, *every* property will be neutral.

20. Something roughly like this strategy emerges in Yablo 1987: 306–8. However, Yablo puts the idea to a very different use. He argues that categorical properties (given a certain version of plenitude) are exactly the neutral properties, and aims to show that these in turn just are what he calls the *cumulative* properties. Cumulative properties are properties that can "build up the essences in which they figure," unlike *restrictive* properties—such as identity and kind properties, which "exercise an inhibiting effect on certain of [their] colleagues." (299) This argument, as well as the picture that Yablo ultimately proposes, requires that neutral properties be in some sense modally independent. While I take one of his core observations on board—that neutrality is the idea we need to fix on—I worry that the further independence requirement packs in implausibly strong commitments about coincidence.

> **Simple Plenitude.** Necessarily, given any material object *o* and any modal profile *M* based on all of *o*'s neutral properties, there is something coincident with *o* which has *M*.

Unlike the proposals that we've considered thus far, Simple Plenitude doesn't require a tendentious taxonomy of properties into modal and nonmodal, sortal and nonsortal, and so on.[21] But it may still look somewhat suspicious. After all, plenitude is a thesis about what coincident objects there are—doesn't the appeal to neutrality threaten circularity?

Insofar as our goal is to articulate and understand a coherent formulation of plenitude, I think any apparent circularity here is harmless. Although exactly which properties are neutral will turn in part on facts not built into the structural definition above, the consequences we uncover using only the structural characterization will hold for any candidate theory of coincidence we might adopt in the background, and thus will constrain any adequate formulation of plenitude. To make sense of the content of plenitude, we don't (yet) need an independent characterization of neutrality. Thus, we can understand Simple Plenitude (and the revisions to follow) as a kind of schematic principle, highly sensitive to the details of the background metaphysics, but informative enough to trace out the contours of the target idea.[22]

The structural definition is far from empty, as we'll see in what follows. It is already enough, for example, to distinguish plenitude from opposing metaphysical pictures. Given only that coincidence entails colocation, anything coincident with my car shares the property of *being inside a garage*. The conservative ontologist will accept that much but deny the corresponding consequence of Simple Plenitude: that there is something coincident with the car that (for example) is essentially inside a garage.

Still, we do need some assurance that neutrality is enough to solve the problem at hand. I've already pointed out that identity properties and capped properties more generally won't turn out to be neutral; but what about the trouble caused by broadly modal properties? Some cases look straightforward: since *being located at r* is neutral, Simple Plenitude

21. And thus, Simple Plenitude doesn't rest on a hyperintensional conception of properties.

22. Notice that my proposed solution is not alone in relying on the details of the background metaphysics; all of the strategies considered so far would have required us to answer further substantive metaphysical questions before producing a list of the putative "good" eggs.

seems to guarantee that *accidentally being located at r* is not. (Suppose that I am located at a region r. Given Simple Plenitude, there is something coincident with me that is essentially located at r and something coincident with me that is only accidentally located at r). So, Simple Plenitude won't then require there to be something essentially *accidentally located at r*. Similarly, being essentially shaped like so won't be neutral, and so Simple Plenitude avoids the incoherent result that there is something accidentally essentially shaped like so. So far, so good.

But the plenitude-lover should still be able to allow for neutral properties that are had essentially if they are had at all. For example, it seems that plenitude is in principle compatible with the following metaphysical thesis:

> **Location.** Necessarily, if something is located, then it is essentially located.[23]

Having a location is clearly a neutral property, if coincidence entails colocation. Thus by Location, being essentially located is also neutral. So, given Simple Plenitude, there is something that is accidentally essentially located.[24]

More worrying, consider the following logical truth:

> **Self-Identity.** Necessarily, everything is self-identical.

Thus, *being self-identical* is (trivially) a neutral property. Given Simple Plenitude, we're led to the absurd conclusion: there is something that is accidentally self-identical. (And, for that matter, something that is accidentally essentially self-identical.)

Should we conclude from these arguments that we were wrongly optimistic about neutrality? Have some "bad eggs" gotten through our net? I think not. Although these are counterexamples to Simple Plenitude, I want to argue that the lesson is not that neutrality is too permissive

23. Although I think that the target idea is in principle compatible with theses like Location, and thus that a formulation incompatible with Location has overstepped, I also think that some of the most interesting versions of plenitude will deny this particular thesis.

24. There are many examples like this, though some are more contentious than others. Consider, for example:

> **Materiality.** Necessarily, if something is a material object, then it is essentially a material object.

If everything coincident with a material object is a material object (and so *being a material object* is neutral), we get the same problem.

for our purposes—we needn't find some more restrictive characterization of the properties that form the bases of modal profiles. Rather, we'll make more progress if we understand the problem as lying elsewhere. We've assumed in formulating Simple Plenitude and its predecessors that plenitude entitles us to say that for any property in the base of a modal profile, there are coincidents that vary with respect to whether they have that property essentially or accidentally. This has led us to run together the "bad eggs" question (How should we characterize the property base of a modal profile?) with another question: Which properties are such that coincidents can differ with respect to their modal status? The answer to that question rests on a solution to the second of the challenges facing the plenitude-lover: the consistency problem.

In what follows, I'll take for granted the appeal to neutrality as a working hypothesis in answer to the bad eggs problem and show how any residual troubles can be addressed by an adequate solution to the consistency problem. My aim in the next two sections is to provide such a solution.

3. The Consistency Problem for Plenitude

Bennett (2004) considers the following sort of case, which turns out to be a counterexample to Simple Plenitude: by Simple Plenitude, there is something coincident with the blue coffee mug on my desk which is essentially blue and only accidentally colored.[25] But such a thing would have to possibly be blue and *not* colored. Since that is metaphysically impossible—nothing can be blue without being colored—Simple Plenitude is false.[26]

Cases like this are easy to come by. Any neutral determinable and one of its determinants will generate this sort of difficulty for Simple Plenitude, but so too will pairs of properties like *being colored* and *being spatially extended*, or *being located in r* and *being located in a subregion of r*. Similarly, Simple Plenitude doesn't rule out modal profiles according

25. In fact, many such somethings—many modal profiles based on the neutral properties there—will require this pattern of modal properties.

26. Bennett's target isn't Simple Plenitude, but instead a view she calls "wild bazillion-thingism." The challenge, says Bennett, is not just to solve this consistency problem, but to do so without winding up with a more "chaste" view than hoped. Similar arguments appear in Yablo 1987 and have been echoed in Leslie 2011, Dasgupta 2016, and Jago 2016. Although the problem has received a lot of attention, it is hard to find explicit proposals for how to address it.

to which *being blue* and *being round* are both had essentially, but *being blue and round* is had only accidentally.

The problem is simply that many neutral properties necessarily entail other neutral properties, and nothing can have a property essentially while possibly lacking some property entailed by it. The sense of entailment here is just standard property entailment:

> A property F entails G iff necessarily, for all x, if Fx then Gx.

We can generalize this to say when a *set* of properties jointly entails a property:

> A set $\mathcal{F}$ of properties entails G iff necessarily, for any x, if x has every property in $\mathcal{F}$, then Gx.

We can define a very natural property of modal profiles in terms of property entailment. Recall that a modal profile M based on a set S of properties is a partition of S into subsets E and A. Here is a first pass:

> A modal profile M based on a set S of properties is *closed** iff for any subset of properties $\mathcal{F}$ of S and any G in S, if $\mathcal{F}$ entails G, then if every property in $\mathcal{F}$ is in E, G is in E.

In other words, if some properties, the Fs, are had essentially according to M, then any property jointly entailed by the Fs is also had essentially according to M. The troublesome profiles described above fail this closure condition. But if we restrict our attention to closed* modal profiles, we avoid them.

However, this condition won't yet suffice to handle the problem posed by neutral properties had essentially if at all. So far, *closure** only guarantees that *if* the property *being self-identical* is in E, *then* the property *being essentially self-identical* will be in E. Nothing yet captures the requirement that *being self-identical* must be in E. So, we should supplement closure* with a further condition:

> A modal profile M based on a set S of properties is *closed* iff (i) for any subset of properties $\mathcal{F}$ of S and any G in S, if $\mathcal{F}$ entails G, then if every property in $\mathcal{F}$ is in E, G is in E and (ii) if F entails being essentially F, F is in E.

Closure accommodates the further observation that when having some neutral property entails having that property essentially, no consistent modal profile can partition that property into A. Thus, the following looks promising:

> **Merely Modal Plenitude.** Necessarily, given any material object *o* and any closed modal profile *M* based on all of *o*'s neutral properties, there is something coincident with *o* which has *M*.

3.1. Problems for Merely Modal Plenitude

Merely Modal Plenitude is promising, but—like many promising things—is false. Closure under property entailment isn't a stringent enough constraint to guarantee the consistency of modal profiles. There are two problems: first, closure doesn't guarantee what we should think of as "metaphysical consistency." That is, some closed modal profiles aren't possibly instantiated by anything. But also: metaphysical consistency doesn't even guarantee what I want to call "local instantiability." Roughly what this means is that the fact that a modal profile *M* based on some object *o* is *possibly* instantiated is no guarantee that it can be instantiated by something actually coincident with that object—even by the plenitude-lover's lights!

In this section, I introduce a family of counterexamples to Merely Modal Plenitude that turn on these challenges. The lesson, I argue, is that consistency of modal profiles is not a merely combinatorial matter—it depends on coordination between how things stand at the actual world and how they might have been. Finally, in section 4, I argue that we can address both problems by replacing closure with a stronger condition. Very roughly, the new condition I'll propose (*nonlocal closure*) looks not just at which patterns of properties are possible, but at how those patterns are spread through modal space.

Here's a first pass at an objection to Merely Modal Plenitude: recall that *being blue* is among the neutral properties of my blue coffee mug. So too is the property *being such that p*, where *p* is some proposition true at exactly this world. And of course, *being such that p* doesn't entail *being blue*—you and I and my green coffee mugs witness that. So, there is a closed modal profile *M* according to which *being such that p* is had essentially, and *being blue* is had accidentally.

Although it is closed, nothing can have that modal profile: *M* requires its bearer to be blue and such that *p*, and to possibly fail to be blue while still being such that *p*. But by stipulation were the world to be otherwise in any way (e.g., if something actually blue weren't blue) *p* would be false, and nothing would be such that *p*. So, *contra* Merely Modal Plenitude, there can't be anything coincident with my blue coffee mug that has modal profile *M*.

It is tempting to dismiss this case because of quibbles about the properties involved. Although I argued above that the restriction to neutral properties captured our target idea, you might think that cases like this reveal that we might not have discriminated carefully enough. Properties like *being such that q* are *trivially* shared by coincidents in q-worlds. Perhaps we had something in mind that was more hyperintensional; for example, properties that are shared by coincidents in virtue of coinciding, or in virtue of occupying some region.[27] I'm inclined to think the target idea behind plenitude doesn't rest on anything so fine-grained, but if my objection can be avoided by moving to a more discerning characterization of neutrality, perhaps I've overstepped.[28]

However, the same counterexample can be rerun another way:

> **Flimsy.** On my kitchen table near the fruit bowl, there is Flimsy. Flimsy is a "modal minimum"—an object that has all of its properties essentially. (Remember, the plenitude-lover should think there are many things like Flimsy, one coincident with every material object.) In the fruit bowl near Flimsy, there is something red—say, an apple. Once again: *being near Flimsy* and *being red* are both neutral properties of the apple, even in the more refined sense suggested above. And again, *being near Flimsy* doesn't entail being red—there are bananas, oranges, and pears in my fruit bowl, too.

By Merely Modal Plenitude, there is something coincident with the apple that is essentially near Flimsy and accidentally red. But there *can't* be any such thing—had anything been otherwise (e.g., had anything red failed to be red) there wouldn't have been Flimsy.

The amended Flimsy case avoids the worry about triviality, but shares something important in common with the first-pass case. Both rely on a property instantiated at exactly one world: in the first, *being such that p*, and in the second, *being near Flimsy*. But in fact the structure of the problem doesn't require even that. Consider another counterexample to Merely Modal Plenitude:

> **Whimsy.** Suppose that on my kitchen table there is also Whimsy. Whimsy isn't as fragile as Flimsy; it can survive some things being otherwise. Whimsy, suppose, actually has a blue half (B) and a green half (G), but had anything been otherwise, Whimsy would have been entirely green. Consider Whimsy's green half, G. By Merely Modal Plenitude, there is

27. See Jago 2016 on *region-focused* properties.

28. Thanks to Mark Jago for discussion of this point.

something coincident with G that essentially spatially overlaps Whimsy and is accidentally green. (This is because overlapping Whimsy doesn't entail being green; witness B.)

Nothing coincident with G can essentially overlap Whimsy and be accidentally green. That would require it to possibly overlap Whimsy while being nongreen, but had anything been otherwise, anything overlapping Whimsy would be green. Postpone for a moment the hard question of why we should think anything like Whimsy is possible. If there could be, then we have a new sort of counterexample that doesn't rely on perfect modal fragility. What's more, in this case, the relevant modal profile is *metaphysically possible*—but still not, in some sense, instantiable *here*.

The condition that a modal profile be closed ensures that whenever a property F is had essentially according to M, and G is had accidentally according to M, it is possible that something be F without being G. As we saw above, this is exactly what we need: the kinds of counterexamples standardly associated with this problem. But in all of my cases, the troublesome profiles *are* closed—it is possible for something to be such that p without being blue, to be near Flimsy without being red, to be near Whimsy without being red, and so on.

The recipe for a case like this is very general: Let F and G both be neutral properties of o at w. Suppose that F and G have the following modal patterns of instantiation: at every world w' distinct from w, every F is G. However, at w, there are some Fs that are not G.

Now let M be a closed modal profile based on o's neutral properties such that F is in E and G is in A.[29] By Merely Modal Plenitude, there is something s coincident with o in w that is *essentially* F and *accidentally* G. Such an s would have to be F and G in w, but at some w' be F and not G. However, by stipulation, at all w' distinct from w, every F is a G. So, there can be no such s, contra Merely Modal Plenitude. Notice that this nowhere relies on the supposition that F is instantiated in exactly one world. In cases where F is instantiated at some worlds distinct from w, the modal profile M is still possible: there might be things at *those* worlds that are essentially F and accidentally G. In fact, the core of the argument doesn't even rely on our restriction to "neutral" properties. *Any* restric-

29. We can convince ourselves there is such a modal profile M as follows. Let N be a closed modal profile based on o, and now construct M from N by placing F (and everything entailed by F) in E, and G in A. Since F doesn't entail G, if N was closed then M is.

tion we might plug into Merely Modal Plenitude that allows properties behaving like F and G will be subject to counterexamples of this form.[30]

4. Nonlocal Entailment, Otherworldly Necessity, and Global Plenitude

The need for a consistency condition more discerning than standard property entailment is forced on us by the nature of modal profiles themselves, and, in particular, by the conditions of *accidentality*. Recall that to have a property accidentally is to have it and to possibly lack it—accidental property possession (unlike essential property possession) requires the cooperation of *two* worlds. So, consider *any* modal profile based on an object o in a world w such that A is nonempty—any modal profile other than the modal minimum. Any such modal profile will require that, for each property G in A, it is possible for something at a world *other* than w to have every property in E and lack G. At bottom, the trouble is that closure (as defined in Section 3) can only assure us that the required pattern of properties is possible, but what we need instead is assurance that the right pattern of properties is possible *elsewhere*.[31]

In this section, I propose a formulation of plenitude that builds on these lessons to address the problems raised above. First, we'll need some new terminology:

> A set $\mathcal{F}$ of properties nonlocally entails G at w iff it is otherworldly necessary that for all x, if x has every property in $\mathcal{F}$, then Gx.

Where:

> It is *otherworldly necessary* that P at w iff at all worlds w' distinct from w, P.

The corresponding condition on modal profiles is:

30. Leslie (2011: 278–9) suggests a constraint on the bases of modal profiles that also builds in a consistency constraint. She requires that the properties be "strongly modally independent, so that each . . . can be possessed either essentially or accidentally without requiring that the other four be possessed essentially, accidentally or even at all, and likewise for any combination of the properties." The resulting version of plenitude runs into the same problem I've raised here: strong modal independence guarantees metaphysical possibility, but not local instantiability.

31. Although Kurtsal (n.d.) doesn't commit to a particular conception of modal profiles or a corresponding notion of consistency, her formulation of *modally full plenitude* suggests that she may instead have in mind something more like sets of properties had either essentially or *possibly*. The resulting formulation of plenitude will be importantly different from the one I describe here. Although it will also require some notion of consistency for profiles, the challenges will be distinct.

A modal profile M based on a set S of properties is *closed under nonlocal entailment* iff (i) for any subset of properties $\mathcal{F}$ of S and any G in S, if $\mathcal{F}$ nonlocally entails G, then if every property in $\mathcal{F}$ is in E, G is in E and (ii) if F entails being essentially F, F is in E.

I want to argue that the lesson of the cases above is that closure under nonlocal entailment (or "nonlocal closure") is the right notion of consistency for modal profiles.

We should flag one thing, first. Notice that closure under nonlocal entailment is *world-relative*—a modal profile M may be closed under nonlocal entailment at one world and not at another. (The modal profile in the Whimsy case has exactly this feature.) But this shouldn't be surprising—after all, plenitude was never meant to be the view that *every* metaphysically possible modal profile was instantiated (presumably the modal profile of Pegasus is possible, but it is no part of plenitude that there is something instantiating that modal profile). Rather, plenitude is the idea that every metaphysically possible modal profile that is (in some sense) compatible with the actual matters of fact is instantiated by something. So, on reflection, it should be no surprise that whether a modal profile is *consistent* in the right sense will depend both on how things are and how they might have been.

Incorporating nonlocal closure into our template delivers the following version of plenitude:

Global Plenitude. Necessarily, given any material object o and any nonlocally closed modal profile M based on all of o's neutral properties, there is something coincident with o which has M.

Consider again the second counterexample, involving *being near Flimsy* and *being red*. Although the modal profile M according to which the latter is had essentially and the former is had accidentally is closed under entailment, it isn't closed under *nonlocal* entailment at the actual world w. If we ignore w and look through all of the rest of modal space, we see that trivially everything near Flimsy is red (because elsewhere, nothing is near Flimsy). In the third counterexample, although there are things near Whimsy at other worlds, they are all red—so, *being near Whimsy* nonlocally entails being red.

5. Ground Floor Humility

There is also some good circumstantial evidence that we are on the right track with Global Plenitude. In this section I describe what I take to be a desideratum of any adequate version of plenitude and suggest that Global Plenitude meets it.

I've argued above that Merely Modal Plenitude is subject to a certain family of counterexamples that arise when we suppose that neutral properties are distributed through modal space in a particular way. We can thus say something more general about Merely Modal Plenitude: it lacks a feature I'll call *ground floor humility*. Very roughly speaking, a plenitude principle is *ground floor humble* if it is compatible with any reasonable hypothesis about the distribution of neutral properties through modal space. My aim in this section is to suggest that unlike Merely Modal Plenitude, Global Plenitude is ground floor humble.

Both Merely Modal Plenitude and Global Plenitude can be thought of as *generative principles*. Broadly put, generative principles generate a domain from a "ground floor." For example, we might think of set-theoretic comprehension principles as generating the universe of sets from a "ground floor" of ur-elements, or of unrestricted mereological composition as generating a domain of composite objects from a ground floor of individuals. In our case, the ground floor for both Merely Modal Plenitude and Global Plenitude is given by the distribution of neutral properties across modal space. The arguments in section 3.1 revealed that there are some hypotheses about the distribution of neutral properties that Merely Modal Plenitude isn't compatible with—and so it clearly isn't ground floor humble. (And more important: the hypotheses that Merely Modal Plenitude is incompatible with are hypotheses the plenitude lover *should* accept.) But how could we go about showing that a plenitude principle is ground floor humble? One problem is that (again) the idea is hard to pin down precisely. It is at least intuitively clear what is meant by ground floor humility, but to get more precise, we have to make sense of the notion of "any reasonable hypothesis about the distribution of neutral properties," and it isn't obvious how to do so.

Here is a sketch of a promising general strategy: we introduce the notion of a "ground model" (which fixes some distribution of neutral properties) and show that any ground model can be expanded to a model satisfying Global Plenitude. Thus, if the result holds for a sufficiently permissive conception of ground models, we'll have shown that Global Plenitude is ground floor humble. In the appendix, I develop a version of this proposal in detail, but sketch the idea briefly below.

A *ground model* G is given by a pair $M = (W, D)$ of a set of worlds W and a family of sets of *ground individuals* D_w for each $w \in W$. (That is, a ground model is just a standard variable domain Kripke model.) A *ground* *property* is a function from worlds to sets of individuals in those worlds. (In the appendix, I use the label *S-property* instead.)

I define a procedure for producing a *global expansion* $M+$ of a ground model M. Very roughly, for every world w, every ground individual x in w, and every partition $\{E,A\}$ of x's ground properties that is nonlocally closed at w, we add a new individual y, which coincides with x in w. In the second stage of the construction, we ensure that for every property f in A, the new individual y also exists in a world w' where it coincides with a ground individual that has every property in E and lacks f. (Ultimately, this will amount to having added an individual for every nonlocally closed modal profile.) Since the procedure assumes nothing about the ground model, we can guarantee that every ground model has a global expansion.

I show that the neutral properties in the resulting model are exactly the "expansions" of the ground properties. (This is mostly intuitive: in every world, each group of coincidents corresponds to exactly one ground individual, and so the ground properties are exactly those that don't distinguish between coincidence classes.) Importantly, then, every ground model corresponds to a different distribution of neutral properties through modal space—a different hypothesis about what properties distinguish between coincidents. I then show the following result:

> **Theorem.** Every global expansion of a ground model is a model of Global Plenitude.

Formal results like this are significant for us in two ways. The first and most important is that they can begin to reassure us that global plenitude can resist the sorts of problems that I've levied at its predecessors. For my purposes here, it is enough that we take an instrumental attitude toward the result in the appendix: that it is humble (in this technical sense) is some evidence that it won't be felled by the kind of counterexamples we've seen so far. The secondary significance is that, although it is a further and much more substantive project to argue that this formal result guarantees that Global Plenitude has the elusive theoretical property I've called ground floor humility, it does constitute significant progress in that direction.[32]

32. For one thing, although it is helpful for illuminating features of Global Plenitude, the construction I describe here doesn't provide a *fully* general tool for evaluating the "humility" of different varieties of plenitude. This should give us pause about the scope of the philosophical import of these results. In future work, I hope to argue that we can

I think it is also worth emphasizing that ground floor humility is an independently attractive and philosophically important property of generative principles. Defending principles that are humble about the ground floor entitles us to a certain kind of epistemic humility that is not usually associated with abundant ontologies, but is clearly desirable in metaphysical theorizing. For an extreme illustration of why humility is a virtue for generative principles, compare a toy principle of mereological composition:

> **Light Fusion.** For any disjoint *xs*, there is some *y* weighing less than a pound that fuses them.

Any model with a sufficiently heavy ground floor will violate Light Fusion. Thus, the defender of Light Fusion is committed to a further metaphysical claim: that the ground floor isn't "too heavy." Global Plenitude, on the other hand, does not rest on any further contentious assumptions about what the possible patterns of neutral properties are. Although she is committed to the claim that material object ontology is modally full in a particular way, the plenitude-lover can remain appropriately cautious about what exactly that fullness amounts to.

Relatedly, plenitude-lovers of a certain stripe might also take the foregoing as evidence that plenitude is in some sense "innocent," or that the proposed profligation of ontology is "cheap," as witnessed by its conservativeness over a large body of modal truths. There is a deep and interesting connection between metaontological minimalism—metaontological views according to which existence is "cheap" or "easy"—and abundant ontologies.[33] For the theorist approaching plenitude from this direction, ground floor humility is an extremely attractive feature of a theory, and bolsters their claim that the expanded ontology does nothing to clutter the modal landscape.

6. Promises of Plenitude

We started out with the goal of making a vague idea precise, and saw that there were serious obstacles to doing so. Cutting our way through the

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circumvent some artifacts of the current construction that are products of our narrow interest in Global Plenitude, and to thereby better understand the relationship between these technical results and "ground floor humility." Thanks to Gabriel Uzquiano and Jeff Russell for extremely helpful discussion of these questions.

33. For extensive discussion of Metaontological Minimalism, see Linnebo 2012. For a recent example of this connection at work, see especially Thomasson 2015.

thicket has led us to Global Plenitude. Of course, questions about the details remain: global plenitude neither tells us what the neutral properties are nor does it provide any account of how they're spread across modal space. I've suggested that the fact that Global Plenitude leaves these questions largely open is a virtue and better characterizes the commitments of the target idea.

More importantly, however, we came to Global Plenitude by considering minimal responses to fully general problems for the plenitudinous idea. Thus, Global Plenitude captures constraints on any adequate formulation of plenitude. Whatever else a plenitude-lover hopes to pack into their preferred account, our observations about neutrality and consistency will constrain the resulting view.

What then do we learn about the target idea? One major upshot of the discussion so far is that, although plenitude is usually associated with utterly unconstrained abundance, we've learned on closer inspection that this abundance will be somewhat tempered by the nature of modal profiles themselves together with our choice of background modal theory. Given that, we might well wonder: do the constraints of Global Plenitude allow us to make good on all of the initial promises of plenitude? Ultimately, I think so, though unsurprisingly things turn out to be much more subtle than we might initially have expected.

Here is just one case study. Plenitude offers an appealing diagnosis of certain paradoxes involving gradual changes. For example, consider the case of a trunk made from six light wood planks. Over time, we remove the light wood planks, and replace them one by one with darker wood. (We focus on this 'Trunk of Theseus' for simplicity, in place of its more unwieldy nautical cousin.)

Familiar questions about whether the trunk survives these changes seem to dissolve easily against the backdrop of plenitude: there are many cube-shaped things at t_1, including some that survive replacement of the first plank but not the second, some that survive replacement of three planks but not four, and some that survive the entire series. On one plenitudinous diagnosis, the difficulty of survival questions has to do with linguistic indeteriminacy surrounding which of these cube-shaped things our word "trunk" picks out. This is just one illustration, but there are more complex puzzles involving the ways that ordinary objects can tolerate changes to their parts with a similar structure. In each it is available to the plenitude-lover to point to the abundance of coincident objects and observe that among them are objects with *these* parts but not *those* essentially, others with *those* parts but not *these* essentially, and so on.[34]

However, a lesson of our progress so far is that this sort of strategy has to be employed with care. In the trunk case, we say that there are very many things at t_1, among them are: the cube that has $a \ldots e$ essentially as parts and can survive replacement of plank *f*, the cube that has $a \ldots d$ essentially as parts and can survive the replacement of planks *e* and *f*, the cube that has $a \ldots c$ as parts, and so on, for any combination of planks.

Naively, it might seem as though this argument relies on an appeal to a much more general principle:

> **Part Variety.** For any disjoint *x*s and *y*s that are proper parts of *z*, something coincident with *z* has the *x*s essentially as parts and the *y*s accidentally as parts.

But the counterexamples we've seen provide us with the template for an argument against Part Variety. As long as perfectly fragile objects—"modal minimums" like Flimsy—are parts of composite objects, Part Variety will fail. An object like Flimsy cannot be essentially a part of something while other more resilient objects are accidentally parts of it.

The defender of Global Plenitude will be hard-pressed to deny that perfectly fragile objects are sometimes proper parts of things. Fragility follows from Global Plenitude as stated:

> **Fragility.** There is something that is perfectly fragile.

Given any object *o*, there will be a nonlocally closed modal profile based on *o*'s neutral properties such that every neutral property of *o* is partitioned into *E*. Since, as we have seen, *o*'s neutral properties include properties equivalent to *being such that p*, where again *p* is true at exactly one world-time, this suffices to guarantee that something coincident with *o* is perfectly fragile.[35]

34. Leslie (2011) proposes this sort of solution to Chisholm's paradoxes of essence, arguing that once we recognize the abundance of instantiated modal profiles, the paradox dissolves. Note that this strategy only goes through if properties like *having the* xs *as parts* are neutral. This, finally, *will* turn on how we understand coincidence: if we understand coincidence as mere co-location and it is possible for co-located objects to nonetheless be mereologically disjoint then mereological properties won't in general be neutral. On such a picture, plenitude has very little to say about cases like the Trunk of Theseus.

35. Alternative versions of plenitude that replace *neutrality* with some more restricted class of properties may avoid this result, but as with the Whimsy case before, we can construct a fusion of objects whose modal lifespans pattern the right way to generate a

Universal Composition guarantees that such objects are sometimes proper parts of things:

Universal Composition. For any *x*s, there exists a *z* such that *z* fuses the *x*s.

Although Universal Composition isn't similarly entailed by Global Plenitude, it does seem to fit with the general background picture: mereological universalism is often motivated by the same concerns for anti-arbitrariness that drove us to plenitude. Given both, there will be composite objects that have perfectly fragile objects as parts, and so Part Variety will fail.

The upshot is that applications of plenitude to familiar metaphysical puzzles, though useful, can't straightforwardly go via prima facie attractive principles like Part Variety. Even given a plenitudinous ontology, we can't cavalierly assume that there are extraordinary objects answering to any old pattern of essential and accidental properties. Instead, we will often need to take the particular cases and examine them against the backdrop of the rest of our metaphysics.

There is much more to be said here: there are a wealth of interesting questions about the mereological pictures available to the plenitude-lover and the kinds of principles of variety we might be able to consistently pair with the view. However, my aims in this section have been more modest: I hope to have suggested that while Global Plenitude *can* make good on many of the promises of the target idea, it *doesn't* license naive appeal to any general principles of abundance. Although the proposed ontology is luxurious, we still must attend to the ledger.

7. Conclusion

Plenitude provides a dramatic picture of the material world: small changes—the flutter of a leaf, or the loss of an atom—shape reality just as radically as the collapse of a star or construction of a new skyscraper. Still, the thought at the heart of the ontological drama seemed simple at first: that metaphysics doesn't privilege some modal profiles over others. We've seen that it is harder to make something sensible out of that simple idea than we might have expected. I've argued here that we can make significant advances on understanding the target idea by considering very general structural observations about neutrality and accidentiality.

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counterexample to Part Variety. The details of this will depend on the details of the replacement proposal.

In particular, I've argued that the intelligibility of plenitude doesn't rest on contentious distinctions between kinds of properties, but also that plenitude is constrained in surprising ways by what it is for an object to have a property *essentially* and *accidentally*. As a result, we find not only an attractive (and in some ways, humble) version of plenitude, but also reveal substantive constraints on any adequate theory of the material world.

Appendix

To argue that Global Plenitude is *ground floor humble*, we'll show that any *ground model* can be expanded to a model of Global Plenitude. First, I introduce the notion of a ground model G, and then show how to construct a *global expansion* $G+$. I then show that any such $G+$ is a model of Global Plenitude.

A.1. Initial Definitions

A *ground model* G is a quadruple $< W, I, d, S >$, where:

- W is a nonempty set of worlds.
- I is a nonempty set of ground individuals.
- d is a function from W to $P(I)$. For notational ease, let $d(w) = D_w$, the domain of ground individuals at w.
- S is the set of all functions from W to $P(I)$ such that $f(w) \subseteq D_w$. We interpret S as the set of properties in the ground model.

It will be helpful later on to be able to refer quickly to all of x's S-properties at a given world, so we'll use the shorthand $S_{x,w}$. That is,

$$S_{x,w} = \{f \in S : x \in f(w)\}.$$

In constructing a global expansion of G, we'll be interested in a particular family of bipartitions of $S_{x,w}$ for each x, w. These are the partitions of $S_{x,w}$ that are *closed under nonlocal entailment*. To define nonlocal closure, we'll need two further definitions: first, that of the *essentialization* of a property, and second, that of *nonlocal entailment*.

We say that for any properties h and f in S,

> h is the *essentialization* of f iff h is the function such that for all x, w, $x \in h(w)$ iff $x \in f(w')$ for all w' such that $x \in D_{w'}$. (I will at times make use of the shorthand f_{ess} to refer to the function that is the essentialization of f.)

And we define nonlocal entailment as follows:

> A set $\mathcal{F}$ of properties *nonlocally entails* a property g at w iff at all w' distinct from w and for all x, if $\forall f \in \mathcal{F}$, $x \in f(w')$, then $x \in g(w')$.

And thus, a bipartition P of $S_{x,w}$ into E and A is *closed under nonlocal entailment* iff

(i) for any subset $\mathcal{F}$ of $S_{x,w}$, if $\mathcal{F}$ nonlocally entails g at w, then if $\mathcal{F} \subseteq E$, then $g \in E$
and
(ii) if f entails h and h is the *essentialization* of f, then f is in E.

Notice regarding condition (ii) that if h is the essentialization of f, then h entails f, so if f also entails h, f is h. Thus, (ii) also says that E must contain every property in $S_{x,w}$ that is its own essentialization.

A.2. Constructing a Global Expansion

To construct a global expansion $G+$ from a ground model G, we will first expand the domain of each world. We proceed in three steps.

Step 1. Build a set D_w^{pre} from each D_w.
For each $x \in D_w$ and each nonlocally closed partition $P = \{E, A\}$ of $S_{x,w}$, add a triple $(w, x, \{E, A\})$ to D_w^{pre}. (We use a triple to encode the ground individual and partition in question.) D_w^{pre} is D_w together with the set of every such triple for every ground individual in D_w.

Step 2. Choose witnesses.
From our definition of nonlocal entailment, we know the following: given a partition $P = \{E, A\}$ of some $S_{x,w}$ that is nonlocally closed at w, for any property f in A, there is some individual z in some world w' distinct from w which has every property in E at w' and lacks f at w' (that is, for all $g \in E$, $z \in g(w')$ and $z \notin f(w')$).

> *Argument.* Suppose for a contradiction that for some $P = \{E, A\}$ of some $S_{x,w}$ that is nonlocally closed at w, and for some $f \in A$, there is no such z. Then, $\forall w' \neq w$, and $\forall z \in w'$, if $z \in g(w')$ for all $g \in E$, then $z \in f(w')$. But then by the definition of nonlocal entailment, E nonlocally entails f at w, and thus P is not nonlocally closed—a contradiction.

We will say therefore that:

> A pair (z, w') is a *witness* to the nonlocal closure (at w) of a partition P of $S_{x,w}$ iff z has every property in E at w' and lacks some f in A at w'. Or, for short, we say that (z, w') is a witness for $(w, x, \{E, A\})$.

We now choose a function *Wit* from the set of pairs of the form $((w, x, \{E, A\}), f)$ where $f \in A$ to $I \times W$, such that each $((w, x, \{E, A\}), f)$ is assigned to some pair (z, w') such that (z, w') is a witness for $(w, x, \{E, A\})$ and $z \notin f(w')$.

It is worth noting two things about witnesses. First, although nonlocal closure guarantees that corresponding to $(w, x, \{E, A\})$ and $f \in A$, there is *some* witness, there may be many. Thus, there will not always be a unique candidate function to choose as *Wit.* Second, it may be that the same (z, w') is assigned to both $((w, x, \{E, A\}), f)$ and $((w, x, \{E, A\}), g)$.

Step 3. Build a set D_w^+ from each D_w^{pre}.
In the final stage of the domain construction, we use the function *Wit* to expand each D_w^{pre} to D_w^+ as follows:

> For every triple (w', x, E, A) and every $f \in A$ such that the pair $((w', x, E, A), f)$ is assigned by *Wit* to some (z, w), add (w', x, E, A) to D_w^+.

So, for every w, D_w^+ is the union of all such triples with D_w^{pre}.

A.3. A Global Expansion

A global expansion $G+$ of a ground model $G = < W, I, d, S >$ is a quintuple $< W, I^+, d^+, S^+, C >$, where:

- W remains unchanged from the ground model.
- I^+ is the union of all D_w^+ for all $w \in W$.
- d^+ is a function that assigns each w to D_w^+.

This much is straightforward, though S^+ and C are slightly more complex. The former is a privileged subset of properties in the new model, corresponding to expansions of the properties S in the ground model, the latter is a binary relation to be interpreted as the *coincidence* relation. To characterize C, we'll first define the set S^+.

The set S^+ is a subset of the set of functions from W to $P(I^+)$. In particular, it is the set of all *expanded properties* f^+, where for each $f \in S$, we define f^+ as follows:

$$f^+(w) = f(w) \cup \{(w, x, \{E, A\}) : x \in f(w)\} \cup \{(w', y, \{E', A'\}) : y \in Wit^{-1}(f(w) \times w)\}$$

That is, at each world w, the expansion f^+ of f includes not only every $x \in f(w)$, but also every triple added for some $x \in f(w)$ in Step 1, and also every triple added in Step 3 for a witness (x, w) such that $x \in f(w)$. Nothing else is in $f^+(w)$.

Intuitively, each property in the ground model corresponds to a property in the global expansion that has as its extension at each world all of the old objects as well as their "corresponding" new objects. S^+ is just the set of all such properties.

We retain the same shorthand as above, and use $S^+_{x,w}$ to denote the set of all of x's S^+ properties at w (which, notice, will now be a proper subset of all of x's properties).

We can now define a binary relation C on I^+, to be interpreted as the *coincidence* relation.

> Let R: $W \rightarrow P(I^+ \times I^+)$ be the function such that $(u, y) \in R$ iff $u \in D^+_w$ and $y \in D^+_w$, $y \in D_w$, and u is a triple added for y in either Step 1 or Step 3 of the construction. That is, either u is a triple of the form $(w, y, \{E, A\})$ for some partition $\{E, A\}$ of $S_{y,w}$ or u is a triple $(w', z, \{E', A'\})$ such that $Wit((w', z, \{E', A'\}), f) = (y, w)$.

Now, let R' be the reflexive closure of R. Let R'' be the symmetric closure of R', and let R''' be the transitive closure of R''. Finally, C is R''', the resulting equivalence relation.

In short, u and y will coincide in w iff $u = y$, or y is a ground individual and u was added to D^+_w for y in the construction of $G+$ (and vice versa), or u and y were added for the same ground individual in w.

A.4. Global Plenitude

To show that an arbitrary global expansion $G+$ is a model of Global Plenitude, we need to show two claims:

> **Claim 1.** A property is in S^+ iff it is a *neutral* property. That is, $\not f \in S^+$ iff for all w, if x and y coincide in w, $x \in \not f(w)$ iff $y \in \not f(w)$.

and

> **Claim 2.** For every w, every $x \in D^+_w$, and every nonlocally closed partition $P = \{\mathcal{E}, \mathcal{A}\}$ of $S^+_{x,w}$, there is some y such that $(x, y) \in C(w)$, and y has every property in $\mathcal{E}$ essentially and every property in $\mathcal{A}$ accidentally at w.

Recall that to say that y has every property in $\mathcal{E}$ essentially and every property in $\mathcal{A}$ accidentally at w is to say that for every $\mathscr{g} \in \mathcal{E}$, $y \in \mathscr{g}(w)$ in every w such that $y \in D_w^+$, and for every $\mathscr{f} \in \mathcal{A}$, $y \in \mathscr{f}(w)$ and there is some w' such that $y \in D_w^+$ and $y \notin \mathscr{f}(w')$.

Proof of Claim 1

We first require a result (Lemma 1) about coincidence, and then will show the biconditional Claim 1 by showing the left-to-right direction (Lemma 2) and then the right-to-left (Lemma 3).

> **Lemma 1.** Let y be an individual in I^+. For all $w \in W$, there is at most one $x \in D_w$ such that $(x, y) \in C(w)$.
>
> *Proof.* We show first that given x, x' in D_w, if $(x, y) \in R(w)$, and $(x', y) \in R(w)$, then $x = x'$.

Let $y = (w', z, \{E, A\})$ for some nonlocally closed partition $P = \{E, A\}$ of $S_{z,w'}$. We consider two cases.

(a) If $w = w'$, then y was added in Step 1 of the construction, and so the only individual in D_w that bears R to y is z. Thus, $x = z$ and $x' = z$, so $x = x'$.

(b) If $w \neq w'$, then y was added in Step 3 of the construction, and for some $f \in S$, $Wit((w', z, \{E, A\}), f) = (x, w)$, and for some $g \in S$, $Wit((w', z, \{E, A\}), g) = (x', w)$. So, for every $h \in E$, $x \in h(w)$ and $x' \in h(w)$. Let $j \in S$ be the function where for all $w \in W$, $j(w) = D_w \cap z$. Thus, $z \in j(w')$. Note that $j = j_{ess}$. So, by the definition of nonlocal closure, $j \in E$. So, $x \in j(w)$ and $x' \in j(w)$. So, $x = z$, $x' = z$, and $x = x'$.

So, given x, x' in D_w, if $(x, y) \in R(w)$, and $(x', y) \in R(w)$, then $x = x'$. However, this is preserved when we take the reflexive closure of R to get R', when we take the symmetric closure of R' to get R'', and finally when we take the transitive closure of R'' to get R'''. So, given x, x' in D_w, if $(x, y) \in C(w)$, and $(x', y) \in C(w)$, then $x = x'$.

We will make use of Lemma 1 frequently in what follows, beginning with the left-to-right direction of Claim 1.

> **Lemma 2.** If $\mathscr{f} \in S^+$ then for all w, if x and y coincide in $w((x, y) \in C(w))$, $x \in \mathscr{f}(w)$ iff $y \in \mathscr{f}(w)$.
>
> *Proof.* Let $x, y \in D_w^+$ for some w. Then, there are $z_1, z_2 \in D_w$, such that $(x, z_1) \in C(w)$ and $(y, z_2) \in C(w)$. (The argument for this is similar to Lemma 1 above. Notice that in the definition of R'', every

> object in D_w^+ for any w is R''-related in w to some ground individual, so every object is therefore related by C to some ground individual in w.)

If $(x, y) \in C(w)$, then since C is an equivalence relation, $(z_1, z_2) \in C(w)$. So, $z_1 = z_2$, since by Lemma 1 distinct ground individuals never coincide. Since $\not{f}$ is in S^+, there is some $f \in S$ such that $\not{f} = f^+$. By definition of f^+, if $(x, y) \in C(w)$, then $x \in f^+(w)$ iff $z_1 \in f^+(w)$ iff $z_2 \in f^+(w)$ iff $y \in f^+(w)$.

> **Lemma 3.** If for all w, if x and y coincide in w ($(x, y) \in C(w)$), $x \in \not{f}(w)$ iff $y \in \not{f}(w)$, then $\not{f} \in S^+$.
>
> *Proof.* We show that if $\not{f}$ is neutral, then there is some function $f \in S$ such that $\not{f} = f^+$. By construction of S^+, this suffices to show that $\not{f} \in S^+$. We first suppose for conditional proof that $\not{f}$ is neutral.

We now define a function $\not{f}| : W \rightarrow P(I)$ such that for every w and every $x \in D_w$, $x \in \not{f}|(w)$ iff $x \in \not{f}(w)$. That is: $\not{f}|$ is just the restriction of $\not{f}$ to ground individuals. So, $\not{f}| \in S$. We now just want to show that for all w and all $y \in D_w^+$, $y \in \not{f}(w)$ iff $y \in \not{f}|^+(w)$.

Let $w \in W$, $y \in D_w^+$, and let x be the ground individual in D_w such that $(x, y) \in C(w)$. Then, $y \in \not{f}|^+(w)$ iff $x \in \not{f}|^+(w)$, by the definition of $\not{f}|^+$. And $x \in \not{f}|^+(w)$ iff $x \in \not{f}|(w)$, also by the definition of $\not{f}|^+$. Further, $x \in \not{f}|(w)$ iff $x \in \not{f}(w)$, by definition of $\not{f}|$ above. Because $\not{f}$ is neutral and x and y coincide in w, $x \in \not{f}(w)$ iff $y \in \not{f}(w)$.

Proof of Claim 2

We will show Claim 2 via two lemmas. First, in Lemma 4, we show that for any world and any individual x in w in a ground model G, and for any nonlocally closed partition $\{E, A\}$ of x's S properties at w, there is an individual in G^+ that coincides with x, and has every property in E^+ essentially and every property in A^+ accidentally. In Lemma 5, we show that for any world and any individual x in w in a global expansion G^+, and any nonlocally closed partition $\{\mathcal{E}, \mathcal{A}\}$ of x's S^+ properties at w, there is an individual in G^+ that coincides with x and has every property in $\mathcal{E}$ essentially and every property in $\mathcal{A}$ accidentally.

> **Lemma 4.** Let $x \in D_w$, and let $\{E, A\}$ be a partition of $S_{x,w}$ that is nonlocally closed at w in G. Then, in any global expansion G^+ of G, there is a y in D_w^+ such that $(x, y) \in C(w)$, $S^+_{x,w} = S^+_{y,w}$, and $Ess(y) = E^+$.

Where $Ess\,(y)$ is the set of all of y's essential S^+ properties, and E^+ is the set of all $f^+ \in S^+$ for every $f \in E$.

Proof. Let $y = (w, x, \{E, A\})$. Then, by the construction of $G+$, $y \in D^+_w$, and by definition of C, $(x, y) \in C(w)$. By Claim 1, $S^+_{x,w} = S^+_{y,w}$. By construction, $E^+ \subseteq Ess(y)$. All that we need to show now is that $Ess(y) \subseteq E^+$, or equivalently, that $A^+ \subseteq Acc(y)$ at w.

For every property $g^+ \in A^+$, we must show that $y \in g^+(w)$ and that there is some w' such that $y \in D^+_{w'}$ and $y \notin g^+(w')$. The first conjunct follows from the observation that $A^+ \subseteq S^+_{y,w}$.

For the second conjunct: if A^+ is empty, we are done. If not, let $g \in A$, and for some z in $D_{w'}$, let $(z, w') = Wit(y, g)$ (recall that $y = (w, x, \{E, A\})$). Then $z \notin g(w')$, so $z \notin g^+(w')$. And since by the definition of C $(y, z) \in C(w')$, then $y \notin g^+(w')$, because again by Claim 1 coincidents share all of their S^+ properties. So, $g^+ \in Acc(y)$ at w. Thus, for any $g \in A$ at w, $g^+ \in Acc(y)$ at w, so $A^+ \subseteq Acc(y)$ at w.

Lemma 5. Let $x \in D^+_w$, and let $\{\mathcal{E}, \mathcal{A}\}$ be a nonlocally closed partition of $S^+_{x,w}$. Then, there is a y in D^+_w such that $(x, y) \in C(w)$, $S^+_{x,w} = S^+_{y,w}$, and $Ess(y) = \mathcal{E}$. (Note that it follows that $Acc(y) = \mathcal{A}$, where $Acc(y)$ is the set of all of y's accidental S^+ properties at w.)

Proof. As above, for every $\mathscr{f}$ in $\mathcal{E}$, define $\mathscr{f}| : W \to P(I)$ such that for every w and every $z \in D_w$, $z \in \mathscr{f}|\,(w)$ iff $z \in \mathscr{f}(w)$. (Again, $\mathscr{f}|$ is just $\mathscr{f}$ restricted to ground individuals.) Let $\mathcal{E}|$ be the set of all such restrictions $\mathscr{f}|$ for every $\mathscr{f}$ in $\mathcal{E}$. Then $\mathcal{E}| \subseteq S_{z,w}$. Similarly, for every $\mathscr{g} \in \mathcal{A}$, define $\mathscr{g}|$. Then $\mathcal{A}| \subseteq S_{z,w}$, and $\{\mathcal{E}|, \mathcal{A}|\}$ is a bipartition of $S_{z,w}$. We now show that $\{\mathcal{E}|, \mathcal{A}|\}$ is a nonlocally closed partition of $S_{z,w}$ in G.

Suppose that $\{\mathcal{E}|, \mathcal{A}|\}$ is *not* nonlocally closed at w in G. Then there is some function $g \notin \mathcal{E}|$ such that the set $\mathcal{E}|$ nonlocally entails g at w. That is, for every $w' \neq w$ and every $u \in D_{w'}$, if for every $\mathscr{f}|$ in $\mathcal{E}|$, $u \in \mathscr{f}|\,(w')$, then $u \in g(w')$.

Now, by the definition of $\mathscr{f}|$, for all $w' \neq w$ and all ground individuals $u \in Dw'$, if $u \in \mathscr{f}(w')$ for every $\mathscr{f} \in \mathcal{E}$, then $u \in \mathscr{f}|\,(w')$ for every $\mathscr{f}$ in $\mathcal{E}$. And, by the definition of g^+, for all $u \in D_{w'}$, if $u \in g(w')$, then $u \in g^+(w')$. So, for all $w' \neq w$ and all $u \in D_{w'}$, if $u \in \mathscr{f}(w')$ for every $\mathscr{f} \in \mathcal{E}$, then $u \in g^+(w')$.

By Lemma 1 and the argument for Lemma 2 above, for any $w' \neq w$, given any $x \in D^+_w$, there is a unique ground individual $z \in D^+_{w'}$ such that

$(z, x) \in C(w')$. By Claim 1, if $x \in f(w')$ for every $f \in \mathcal{E}$, then $z \in f(w')$ for every $f \in \mathcal{E}$, because coincidents share all of their S^+ properties. But by the above, for any such z, if $z \in f(w')$ for every $f \in \mathcal{E}$, then $z \in g^+(w')$.

However, $\{\mathcal{E}, \mathcal{A}\}$ is nonlocally closed in S^+, so it follows that $g^+ \in \mathcal{E}$. But $g = g^+|$, so $g \in \mathcal{E}|$. Contradiction.

Thus, $\{\mathcal{E}|, \mathcal{A}|\}$ is a nonlocally closed partition of $S_{z,w}$ in G. By *Lemma 4*, there is a y in D_w^+ such that $(y, z) \in C(w)$, $S_{y,w}^+ = S_{z,w}^+$ and $Ess(y) = \mathcal{E}|^+$. By the definition of $\mathcal{E}|$, $\mathcal{E}|^+ = \mathcal{E}(y)$. So, $Ess = \mathcal{E}$.

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