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The Overlap Problem[1]

It is common to think that it's possible for objects to spatially coincide, in part or in whole, in multiple ways: with overcrowding (as with two bosons located in the same region, not made of anything in common), and without overcrowding (as with a statue and a lump of clay, or the right two-thirds of a table and the left two-thirds of a table). Typically, we can distinguish between these two kinds of spatial overlap by claiming that objects can spatially overlap without overcrowding only if they share parts. However, if we think that mereologically unusual objects, such as extended simples or some kinds of gunk, can also spatially overlap crowded and uncrowded ways, we lose the ability to distinguish between those varieties of spatial overlap via appeal to shared parts. Thus, we should either reject the possibilities that generated this difficulty, or we must look for an alternative explanation of these varieties of spatial overlap.

This paper will proceed as follows. In §1 I will describe background theories of parthood and location, and describe views about how objects and location relate. In the process, I'll describe failures of some kinds of harmony, involving extended simples, gunk, and varieties of colocation. In §2 I will describe the problem we face if we believe mereologically unusual objects such as extended simples and gunky objects can be colocated in crowded and uncrowded ways. (I will also briefly describe how this difficulty may arise even for ordinary objects decomposing into points, though this version of the problem is weaker.) I'll describe how we might respond to this difficulty by endorsing a slight revision to our theory of parthood, allowing us to appeal to shared parts of the colocated objects, though the things are distinct and have no proper parts in common. I will also discuss a response that appeals to a constitution relation between entities.[2] In §3 I will discuss a challenge the extended simples theorist faces if they

[1] Thanks to Andrew Bacon, Ned Markosian, the audience at the 2017 Syracuse Philosophy Annual Workshop and Network, and the Notre Dame Metaphysics Reading Group for their help on this paper. Thanks also to an exceptionally patient and thorough referee for their very helpful comments.

[2] A note on terminology: I'll use 'entity' as a fully general term to apply to whatever exists. I'll use 'thing' as a restriction on the category of entities, to (very roughly) pick out individuals that are referents of count nouns (though this isn't perfect). 'Object' will be a further restriction, to apply to material things that are (at least typically taken to

believe the sorts of mereologically unusual objects discussed in §2 can partially spatially overlap in crowded and uncrowded ways. This challenge is harder to address, as the responses to the problem proposed in the previous section will not help us here. In §4 I will discuss, though ultimately reject, the very natural option of explaining the differences between my cases via appeal to *stuff*. Finally, in §5 I will briefly mention a few of the many other ways in which we might respond to the difficulties I have raised. Among these: we may reject the possibility of crowded partial overlap, we may endorse harmony principles that rule out these cases, and we may reject the possibility of gunk and of extended simples. I'm inclined to endorse all three of those responses, and would be happy for the reader to find motivation from my arguments for any one of them.

1. Parthood and Location

I'll begin with some quick background on parthood and location. Sometimes entities are parts of other entities. For instance, your hand is a part of your body, this sentence is part of this paper, etc. Sometimes entities share parts, as the left two-thirds of a table and the right two-thirds of that table do. And sometimes entities collectively make up a further entity, as when the atoms in a given region collectively make up a chair. Thus, there's a whole family of relations, the mereological relations, having to do with when some entities make up other entities. Commonly, theorists take one mereological relation as not defined in terms of the others, and then define all of the others in terms of it.[3] For instance, we could take *proper parthood* (intuitively: being *some but not all* of something else) or *parthood* (being *some or all* of something) as primitive and then define the other in terms of it using one of the following definitions:

- '*x* is a *proper part* of *y*' $=_{df}$ *x* is part of *y* and *x* is not identical to *y*
- '*x* is a *part* of *y*' $=_{df}$ *x* is a proper part of *y*, or *x* is identical to *y*[4]

We can then define other mereological relations in terms of these:

- '*x overlaps y*' $=_{df}$ there exists a *z* such that *z* is a part of *x* and *z* is a part of *y*

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be) not events, regions, states of affairs, etc. I'll use 'plurality' to pick out *some entities* where that may be one or more of them, and 'stuff' which (again: very roughly) picks out referents of mass terms. I'll discuss the distinction between things and stuff in greater detail in §4. Obviously, I'm only giving a very rough characterization of these categories.

[3] For instance: Leśniewski (beginning in 1916, collected and translated in Leśniewski 1992), Leonard and Goodman (1940), Simons (1987), and Casati and Varzi (1999). The definitions presented here are presented by these authors.

[4] This is a technical sense of 'part'; 'proper part' is a better candidate for corresponding to our ordinary concept of *part.*

- '*x* is a *fusion of* the *y*s' $=_{df}$ each of the *y*s is a part of *x*, and every part of *x* overlaps at least one of the *y*s.[5]

Finally, throughout this paper I'll frequently talk of *complete decompositions*.

- 'the *y*s are a *complete decomposition* of *x*' $=_{df}$ *x* is a fusion of the *y*s.

Just as there are many mereological relations, there are also many locative relations, or ways of being in or at regions. Something can fill a region, or be contained in a region, or overlap a region. The central relation we'll focus on in this paper is that of being *exactly* at a region. This is sometimes taken as primitive.[6] But roughly, something is exactly located at a region if it fills the region, is contained in it.[7] So, for instance, the exact location of an almond is the region shaped exactly like it, that's filled by the almond and that contains all of the parts that make up the almond. If we think that the almond is three-dimensional, this will be a spatial region. If we think the almond is four-dimensional, its exact location will be a spacetime region. I'll focus on spatial regions in this paper, but everything I say can be applied to spatiotemporal regions instead, if you think the exact locations of the relevant entities are spacetime regions.

In our ordinary experience, there seem to be close connections between objects and their locations. An object is where its parts are. All of an object's distinct parts are at distinct locations, each of those distinct locations is a subregion of the region at which the whole is located, etc. Harmony principles capture various ways in which objects and their locations match.[8] One intuitive way to endorse a kind of harmony is to think this: when matching objects to locations, we can't have too few objects and parts of objects, and we can't have too many.[9] So, for instance, if something extends across numerically distinct regions it must have numerically distinct parts as well. And conversely, for any single location, there can't be more than one object exactly located there.

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[5] I'll use *fuses* and *is a fusion of* interchangeably. A *fusion* full-stop is something that is a fusion of one or more entities.
[6] See Hudson (2006).
[7] Though if you're taking this relation as primitive, this will not be a definition. And it is controversial whether it is a listing of necessary and sufficient conditions.
[8] Harmony principles are discussed in Schaffer (2009), Saucedo (2011), Uzquiano (2011), Gilmore (2014), and Leonard (2016). One very strong principle is *Mereological Harmony*, according to which the mereological and logical properties of and relations between objects exactly match the mereological and logical properties of and relations between the exact locations of those objects (Schaffer 2009).
[9] For ease of discussion I'll be assuming that all material objects have exact locations. The overlap problems I raise in §3 will not depend on this assumption (though rejecting it would complicate the presentation of the problems).

Though this picture is intuitive, it is not uncontroversial. For instance, consider the requirement to have enough objects in relation to regions: we can reject this by positing the possibility of spanning[10] extended simples that occupy non-simple regions. Spanning extended simples (henceforth just 'extended simples') are objects that fill extended regions, but do not have any smaller parts within those regions.[11] More precisely, to say that a simple *spans* a region is to say:

- '*x* spans *r*' $=_{df}$ *x* is exactly located at a superregion of *r*, and x does not have any part that is exactly located at any proper subregion of *r*[12]

So, for instance, if my table (or, if it's easier, a Planck-length portion of it) is an extended simple that spans its exact location, then the object has no proper parts, and it has no parts (proper or improper) exactly located at any proper subregions of its exact location. So it has no left and right halves, it has no point-sized atoms making it up, and so on. Markosian (1998, 2004) has presented and argued for a view on which maximally continuous objects are extended simples.[13] McDaniel (2007b) and Saucedo (2011) offer recombination arguments to support the possibility of spanning extended simples. McDaniel (2007a) has argued that Physics may give us reason to claim they are possible. And conceivability arguments for the possibility of extended simples are presented by Markosian (1998 and 2015) and discussed by Gilmore (2014).

Another way to have fewer objects than harmony principles might require is to have gunky objects in space made of points (or even just in space that is gunky, but more plentifully so than our gunky object[14]). An object is gunky iff each part of the object has proper parts. For a paradigm example, imagine a candy bar with right and left halves as

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[10] Presented by Gilmore (2004), and discussed by McDaniel (2003 and 2007b), and Hudson (2006).

[11] Being a spanner and being an extended simple can (at least logically) come apart. First, extended simples can multilocate rather than span (discussed in Parsons (2003), Hudson (2006), and McDaniel (2007b)). For instance, suppose an extended simple is exactly located at a composite region, *r*, and it is also exactly located at every subregion of that region (so it is multilocated within itself). It will not span that region even though it has no proper parts. I'll set aside multilocating extended simples, but you can find arguments against them in Kleinschmidt (2011). Second, spanners can be composite rather than simple. For instance, suppose a composite object is such that it and every part of it is exactly located at the same extended, composite region, *r*, without having any parts (proper or improper) exactly located at any proper subregions of *r*. In this case, the composite object (and each of its parts!) will span *r*. And if that composite object is gunky, it and its parts can span *r* without there being any simples that do so.

[12] This is nearly exactly the definition presented and discussed by Hudson (2006), p. 101.

[13] An entity is maximally continuous just in case it fills a continuous region that is not a proper subregion of a continuous, filled region. A region is continuous, roughly, just in case, between any two subregions of the region, there's a path between them that doesn't go outside the region.

[14] These cases can be as simple as: an exactly occupied, gunky region is divisible into halves, fourths, eighths, sixteenths, etc. The object occupying it is missing every other level of decomposition: it's wholly decomposable into corresponding halves, but not fourths (it lacks the relevant fusions of smaller parts); into eighths but not sixteenths, etc.

parts, and which is such that each of those halves itself has two halves which are its parts, and those halves each have halves as parts, and so on. Imagine further that the object has no point-sized parts. There will be no smallest parts of our candy bar; each of its parts has further, smaller parts. Technically, a point-sized object could be gunky: for instance, a point-sized object could have two point-sized proper parts each colocated with it, and they could in turn have point-sized proper parts sharing the same location, and so on. For the purposes of this paper, I will ignore this sort of gunk, and henceforth will use 'gunk' to refer to an object that is gunky and has no parts with zero extension.

Let's return to the general intuitive picture described above, that we should have neither too few objects and parts, nor too many. So far, I've described two ways to have too few objects. But one may also (or instead) posit too many objects, for instance by positing colocation: multiple, numerically distinct objects with the same exact location. There are two ways colocation might occur. For the first sort, which I'll call *uncrowded* colocation, the statue and the lump of clay that makes it up are a paradigm example.[15] Though we may raise worries about this sort of colocation (an over-proliferation of entities in our ontology, the grounding problem, violation of Extensionality, etc.), this case does not seem to involve overcrowding. We're not surprised, for instance, that repulsive forces do not keep the lump of clay out of the region the statue inhabits. This is in contrast with a second kind of colocation, which I'll call *crowded* colocation. This is what one might think occurs when, for instance, two bosons occupy the same region, or when Casper the Friendly Ghost occupies exactly the same region as you. In this second kind of colocation, there definitely seems to be overcrowding: we may be surprised that there is room in the region for both bosons. And we may attempt to explain the possibility of your colocating with Casper by claiming that Casper is made of a sort of matter that needn't obey ordinary physical laws. There is no need for such claims in the statue/lump case. Finally, uncrowded colocation puts us in danger of some form of double-counting if we count the residents of the location more than once. To see what I have in mind with double-counting, consider David Lewis's discussion of the plurality of cats (i.e., just *all the cats*) in relation to the fusion of all cats.[16] When listing what exists, it seems like we're counting the same "portion of reality" twice-over if we count the fusion of all cats and the plurality of all cats, in a way that we aren't double-counting if

[15] Gibbard (1975). If you think the statue and/or lump have exact locations that are extended in time as well as in space, then assume the statue and lump coincide spatiotemporally rather than merely spatially.
[16] Lewis (1991), p. 81.

we count the fusion of all cats and the fusion of all dogs. Lewis believed that there was an important sense in which the fusion is ontologically innocent: a fusion corresponds to the same portion of reality as the plurality of its parts. Similarly, if I return home from the store listing the items I've bought, there's a sense in which I would be double-counting if I were to list as separate items a statue and the clay it is made of, but I would not be double-counting if I were to list the statue and a book.[17] And unlike the statue and the clay, in the case of Casper colocating with you, if we counted both you and Casper we wouldn't be double-counting. You and Casper are not the same portion of reality.

Importantly, I take there to be an intuitive difference between crowded and uncrowded colocation, and I'm interested in in thinking about how to capture that without making assumptions about relations to mereology; in particular, in my initial descriptions I do not want to assume that the difference follows from a mereological definition of crowded or uncrowded colocation.[18] However, it does seem plausible that the difference is a mereological one: in typical cases where colocation does not involve overcrowding, as with the statue and the lump, the colocated objects share parts. In typical cases where colocation involves overcrowding, the colocated objects do not share parts. So Mereology seems to provide us with an excellent explanation of how the cases differ.

A host of reasons have been offered in favor of the possibility of uncrowded colocation, and recombination arguments[19] and conceivability arguments have been offered in favor of crowded colocation. If we are compelled by recombination and conceivability arguments to posit the possibility of various forms of colocation along with either spanning extended simples or atomless gunk, we may also be inclined to posit the possibility of extended simples or gunky objects (or combinations of objects with various mereological structures) that colocate in a variety of ways.

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[17] There are differences between the statue/lump case and the cat fusion/cat plurality case. The cat-fusion and the plurality of all cats have a fusion in common (namely, the cat-fusion). The lump and the statue may not (depending on the other claims you make). Bricker (2016) takes sharing a fusion to be what it is for some plurality (that is, a collection with one or more members) to be the same portion of reality as another plurality. Though I'd like to remain neutral (at least here) on the question of whether the statue and lump share a fusion, I am appealing to an intuitive notion of *portion of reality* that may not have the features Bricker attributes to it.

[18] This is also why I've avoided using terminology sometimes attached to these different kinds of colocation. For instance, *coincidence* or *material coincidence* has been presented as spatial overlap that involves part-sharing. And *interpenetration* has been presented as spatial overlap that involves no sharing of parts. (See, for instance, Olson (2001), Paul (2006), and Gilmore (2014).) I am avoiding attaching these terms to crowded and uncrowded colocation and overlap because if a theorist thinks there can be uncrowded spatial overlap (without colocation) of extended simples, then coincidence will come apart from uncrowded spatial overlap in at least some possible cases.

[19] McDaniel (2007a), Saucedo (2011), and Gilmore (2014).

2. The Colocation Problem

Suppose we think that spanning extended simples are possible, or that gunk is possible. And suppose we think that varieties of colocation are possible: we think the lump and statue can be colocated uncrowdedly, and that bosons (or you and Casper, or some variant) can be colocated crowdedly. It's a prima facie plausible further step, then, to believe that, possibly, some of the objects colocating in crowded ways are extended simples or gunky, and possibly, some of the objects colocating in uncrowded ways are extended simples or gunky.[20] That is: if we think that objects with a wide range of mereological structures can exist, it seems plausible that objects with a wide range of mereological structures can located in crowded and uncrowded ways. This may be due to features of our motivation for our mereological claims (which I'll note below), or because of recombination principles. At the very least, blocking this sort of recombination will require additional and interesting restrictions. And if we allow the recombination, we get The Colocation Problem. (There will be immediate responses to this problem, but I'll go on to show how those responses fall short in the follow-up puzzle, The Overlap Problem.)

2.1 The Problematic Cases

First, let's consider extended simples. There are a few reasons we might think that spanning extended simples can colocate in these ways. Many of the pieces of motivation I mentioned above in favor of positing the possibility of extended simples also support thinking that a wide variety of objects can be extended simples. For instance, to start by considering potential cases of uncrowded colocation: if we think that necessarily, anything maximally continuous (i.e., filling a continuous region that is not a proper subregion of a continuous, filled region) and extended is simple, and we think it's possible for something much like a statue to be extended and maximally continuous,[21] then an entity much like a statue could be extended and lack proper parts. And it seems plausible that something like a lump, if also maximally continuous, could be extended and simple as well, and that it could coincide with a statue-like simple, differing from it in its persistence conditions and the like. Another route to uncrowded colocation of simples is via shrinking and growth cases, if we think something can shrink down to one

[20] I'll talk as if theorists accepting all of these steps would think lumps, statues, people, and ghosts could be extended simples, but really we just need that *some* entities colocating crowdedly and uncrowdedly are extended simples.
[21] Ordinary statues aren't spatially continuous, but we could imagine a possible statue that is spatially continuous.

of its simple parts, or grow from one of its simple parts (here, the simples may be extended or not, as you prefer). If you think that in general, an object is distinct from and colocated with the smaller part it shrinks to post-shrinking, or it's distinct from and colocated with the smaller part it grows from pre-growth, we will have cases (post-shrinking or pre-growth) where distinct, simple objects are colocated uncrowdedly.[22]

For crowded colocation: If we posit simples because of a general liberalism about recombination and we think colocation of distinct objects without part-sharing is possible, it seems plausible that at least some pairs of these objects can fail to be composite, leading us to think that crowded colocation of simples is possible; nothing about their being simple or composite seems relevant to their ability to colocate. Though there is room to posit the possibility of extended simples, and the possibility of varieties of colocation, without taking the further step of believing that extended simples can colocate in this variety of ways, I think it is a natural step for this theorist to take.

Here is the immediate puzzle: In the last section, we noted that there is an intuitive difference between how a statue/lump pair colocate, and how you might colocate with Casper. If we discover that each of the objects, the statue, lump, you, and Casper, is an extended simple, I believe the intuitive difference between the ways in which they're colocated remains. In terms of how much is able to fit in a single region, it is more surprising that you can colocate with Casper than that the statue can colocate with the lump: if we discover that Casper has colocated with you, or that two tiny particles have colocated with one another, we might be tempted to object: "There's not enough room!" But, even if we have a host of other objections to colocation of the statue and the lump, "not enough room" shouldn't be one of them. The case involving you and Casper seems to involve an overcrowding that the case of the statue and lump does not, and this seems to be the case regardless of whether the objects are simple.

[22] One case like this is Eric Olson's Problem of Disembodied Survival (Olson 2001, §6), where a person is a body/soul fusion, but then shrinks down to just a mereologically simple soul while remaining numerically distinct from it. If we think the soul is located, this will be an example of uncrowded colocation involving at least one simple. And even if it is not located, as Jean-Baptiste Guillon (2019) argues, there is a close connection between the person and the soul that will not be explainable via appeal to shared proper parts. Guillon argues that, if we think that post-shrinking the person and soul are distinct and stand in a constitution relation but not in any parthood relation, we will not be able to account for this relation via appeal to a sharing of parts or proper parts. One reason this kind of case is especially interesting is that, if we think this sort of case is possible, not only does it raise many of the same difficulties as those I raise in this paper, it also resists any account of constitution that appeals to locative features or shared material matter. So, for instance, a stuff-solution in response to this sort of example would have to appeal to something like immaterial stuff.

Unfortunately, if we're dealing with cases involving extended simples, we can no longer capture the difference between the two types of colocation in these cases by saying that in one case the objects share proper parts, and in the other they do not. This is, of course, because none of the objects involved have any proper parts: this follows from our stipulation that they are simple.

We can raise the same sort of worry using other sorts of objects. Let us consider gunk. Often, theorists who think gunk is possible also believe that a wide variety of objects can be gunky: things like people, statues, etc. Again, as with the extended simples theorist, if a gunk theorist believes crowded and uncrowded colocation are possible, it is a natural further step to believe that gunky objects can be colocated in crowded and uncrowded ways. However, problems arise if we endorse a further, very controversial possibility: suppose we believe that gunky parts of coincident objects can be misaligned, where any complete decomposition of one object (i.e., a plurality of parts such that the object is a fusion of them) shares no parts in common with any complete decomposition of the other object. To show how this causes problems, suppose that in our cases of crowded and uncrowded colocation, this sort of misalignment of gunky objects occurs. Suppose a statue's proper parts consist entirely of one-dimensional, horizontally-oriented gunky parts. And suppose that the lump's proper parts consist entirely of one-dimensional, vertically-aligned gunky parts. The statue and lump will have no proper parts in common. Now suppose that your proper parts consist entirely of one-dimensional, horizontally-oriented gunky parts. And Casper's proper parts consist of vertically-aligned gunky parts. When you colocate, you share no proper parts. Still, in spite of these odd decompositional facts, the statue/lump colocation seems to be uncrowded, and your and Casper's colocation seems crowded. And, as with the cases involving extended simples, we cannot capture this by appeal to shared proper parts.

The decompositions I just described are strange. Another, perhaps less strange, way to motivate the problem involves positing colocated objects with different sorts of decompositions. For instance, suppose we think the statue, as a work of art, is an extended simple, but the lump is gunky or is made of point-sized parts. And suppose we similarly take Casper, this ghosty thing, to be extended and simple, but we think you are decomposable into gunk or into point-sized parts. In both cases, the objects will share no proper parts in common (because one member of each pair is simple). There still seems to be a difference in how these objects would colocate, but we cannot capture it by appeal

to shared proper parts. And we don't need simples to generate this problem: we get similar results if, for instance, we take the statue and Casper to each be gunky (with no point-sized parts), and the lump and you to each be made of point-sized proper parts (with no larger proper-parts).

Finally, consider point-sized objects. If we think a pair of simple, point-sized objects can colocate crowdedly, and also that a pair can colocate uncrowdedly, we will not be able to appeal to facts about sharing of proper parts to explain this difference, because in each case there are no objects that are proper parts of both points. Of course, there are good reasons we may resist the thought that point-sized objects can colocate uncrowdedly; in the earlier cases, I was able to motivate the possibility of uncrowded colocation by taking a paradigm case (the statue/lump) and arguing that, even if these entities have strange mereological features, they still seem to colocate in an uncrowded way. In the case of points, perhaps the best I can do is to claim that if we think extended simples can colocate uncrowdedly, we may think that unextended simples can also colocate uncrowdedly. But of course there are many ways to resist that; among them, we may want to explain the difference between crowded and uncrowded colocation by appeal to differences in what's going on at proper subregions of the region at which the colocated objects are located. Nonetheless, *if* we think points can colocate in crowded and uncrowded ways, we have a puzzle of how to explain this difference.

The cases I've described are strange, and I haven't given motivation for thinking that many of them (such as misaligned gunk, extended simple statues made of gunky lumps, etc.) are possible. The cases in the next section will be at once more problematic and easier to motivate. But my aim in describing several cases for the initial problem is to show the range of pictures on which varieties of colocation raise a puzzle for us.

2.2 Responses to the Colocation Problem

So, if we think that any of the unusual statue/lump and you/Casper cases (or similar cases with pointy objects) are possible, and that there's a difference between the two sorts of colocation instantiated in the pairs of cases, how should we capture that? There are many ways that we might respond, but two responses in particular allow us to stay very close to the natural explanation of the difference between crowded and uncrowded colocation that we've been discussing.

Here is the first response. Instead of appealing to a sharing of *proper* parts to explain how uncrowded and crowded colocation differ, we can simply appeal to a sharing of parts. We may say: in each case of uncrowded colocation, the entities in question must share at least one part. In the case of a statue and a lump, for instance, we may say that the lump is part of the statue. Since the lump is distinct from the statue, if we endorse the definition of *proper parthood* presented in §1, this produces the result that the lump is a proper part of the statue. The lump and statue don't yet share a proper part (because there is no object that is a proper part of both the lump and statue), but they do share a part.

If we endorse this response, we will run into three complications. First, the case violates Weak Supplementation (the principle that if an object has a proper part, it must also have another part that doesn't overlap the first). And if, in the case, the statue is also part of the lump, the case will violate the Asymmetry of Proper Parthood (which says no two objects can be proper parts of one another). Finally, if we endorse this as a response to the case involving colocated extended simples, our claim that the lump is a proper part of the statue is in immediate conflict with our claim that the statue lacks proper parts.

In response to these worries, we may endorse an alternative definition of *proper parthood*. Cotnoir (2010) has argued in favor of endorsing the following definition:

- '*x* is a *proper part* of *y*' $=_{df}$ *x* is part of *y* and *y* is not part of *x*.

That is: proper parthood is just asymmetric parthood. We can then posit three kinds of parthood: symmetric parthood with identity (improper parthood), symmetric parthood between distinct entities, and asymmetric parthood between distinct entities (proper parthood).

If we use Cotnoir's definition, and we think the lump and statue are parts of one another, our three problems are solved. The lump's being a part of and distinct from the statue does not violate Weak Supplementation, for the lump is not a proper part of the statue; instead, it is a symmetric and distinct part of it. The Asymmetry of Proper Parthood is also not violated, as the case doesn't involve proper parts. Finally, using Cotnoir's definition, if we think that an entity is simple insofar as it lacks proper parts (rather than simple insofar as it lacks parts distinct from it), we can claim that uncrowded colocation always involves a sharing of parts, even in cases involving colocated simples. We can say the lump is a distinct part of the statue and the statue is nonetheless simple, as

long as the statue is also part of the lump. They share parts, but lack proper parts. In cases of crowded colocation, in contrast, the objects do not share parts.

There are two objections we might give to this response. First, though the statue/lump case will no longer violate Weak Supplementation (because there are no proper parts in that case, according to Cotnoir's definition), it will violate a nearby version of Weak Supplementation, about supplementation of parts of the object that are distinct from the whole. That is, we might find the following thought plausible: for any part of an object, either it's the whole thing, or it's not the whole thing and there's more to the whole than just the part. Cotnoir's category of symmetric parts without identity will occupy a strange middle-ground violating this principle.

Second, we may resist the claim that in addition to the lump being part of the statue, the statue is part of the lump. We may think that, though there is a sense in which the lump makes up the statue, it is implausible that the statue makes up the lump. For those wanting to take this line, there is another natural response that allows us to stay close to the intuitive explanation discussed in the previous section, but which avoids the problems faced by the shared-parts response just described. This new response says that what sets uncrowded colocation apart from crowded colocation is that with uncrowded colocation, one of the entities constitutes the other. Constitution is typically taken to be an asymmetric relation, where one of the entities *completely makes up* the other. There is debate about which ontological categories (individual things, stuff, pluralities) the relata belong to and which mereological features are involved. But if we take the relation to be asymmetric, we cannot understand it as the relation of symmetric parthood with distinctness described above. We could, however, claim it is a new parthood-like relation between things, and use it to distinguish between the two types of colocation. By positing a new relation instead of depending on parthood to do this work, we can continue to endorse principles applied to parthood relations such as Weak Supplementation and the Asymmetry of Proper Parthood. And in cases of extended simples, we can maintain that the entities are extended and mereologically simple even when they are constituted by distinct things. This response is less theoretically parsimonious, but arguably is a better match for our intuitions about these cases.

Finally, there is a third and quite decisive response to any puzzle arising from the possibility of colocated objects: we can simply deny the possibility of objects colocating.

In particular, in responding to the cases I've presented, we can deny that crowded colocation is possible, that uncrowded colocation of objects is possible,[23] or both.

There are many objections you might raise for each of these solutions to my puzzle. For instance, you might object to the first solution's requirement that in any case of uncrowded colocation of simples, the objects are parts of one another, rather than just one being part of the other. Or you may object to our positing an entirely new parthood-like relation of constitution between objects (at least, without intermediate constituting stuff). However, I believe that even if there are good responses to all of those objections, the solutions still fall short for theorists who endorse the possibility of extended simples or gunk. This is because, just as it was natural for such theorists to think it is possible for extended simples or gunk to be involved in crowded or uncrowded colocation, it will be natural for these theorists to think that such objects can be involved in cases of crowded or uncrowded mere partial spatial[24] overlap. And none of the three solutions just discussed has the resources to explain the difference between crowded and uncrowded spatial overlap in those cases. It is to this puzzle that we shall now turn.

3. The Overlap Problem

Consider the left two-thirds of a table and the right two-thirds of that table. (If you don't believe there are objects corresponding to those, you can substitute an example you prefer.) They spatially overlap in an uncrowded way: we aren't surprised that there's enough room in the vicinity for both. In contrast, suppose Casper merely partially spatially overlaps with you: his right side overlaps your left side. This is surprising, in the same way it would be surprising if Casper were to colocate with you: it doesn't seem there's room for both of you in the fusion of the regions filled by either of you. This is crowded spatial overlap. It is tempting to account for the difference between crowded and uncrowded spatial overlap just as we account for the difference between crowded and uncrowded colocation. But if we are liberal enough about possibilities involving extended simples and gunk, this will not be straightforward.

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[23] For instance, see the many responses to the Problem of Material Constitution covered in Rea, 1997.

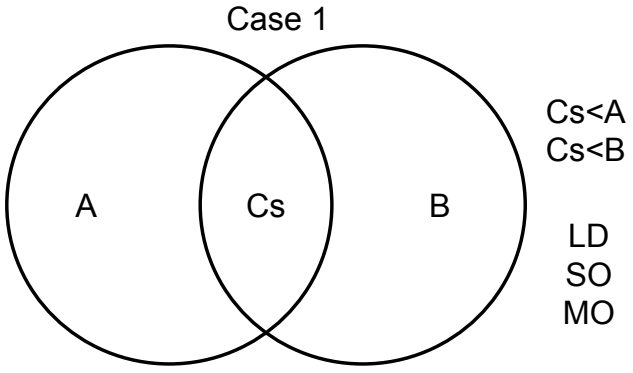
[24] If you think objects are extended in time as well as space, and exactly located at spacetime regions rather than merely at spatial regions, please read 'spatial overlap' as 'spatiotemporal overlap' throughout this paper.

3.1 Spatially Overlapping Extended Simples

If we think that extended simples can be colocated in the ways described in the preceding section, it seems plausible that we should also think that simples can spatially merely overlap in crowded and uncrowded ways as well.[25] For instance, we may think that the left two-thirds of the table and the right two-thirds of the table overlap in an uncrowded way even if the table has no other proper parts (and has no smaller parts).[26] And just as we may think that you and Casper can colocate in a crowded way even if you're each extended and simple, we might think that you and Casper can merely partly spatially overlap in a crowded way when simple as well. Insofar as we think these sorts of cases are possible, and that there is a difference between the crowded overlap and uncrowded overlap involved, we should explain this difference.

Before looking at how we might attempt to do so, I'll present the problematic cases again more slowly, approaching them slightly differently. I'll begin with the normal, everyday case and work from there toward the strangest case.

- *Case 1:* A and B partially overlap in space. They do this cooperatively: by sharing parts within the regions they both fill. A and B are each liberally decomposable enough (i.e., have enough proper parts such that) that the largest region A and B both fill is wholly decomposable into regions occupied by entities that are parts of both A and B (the Cs).

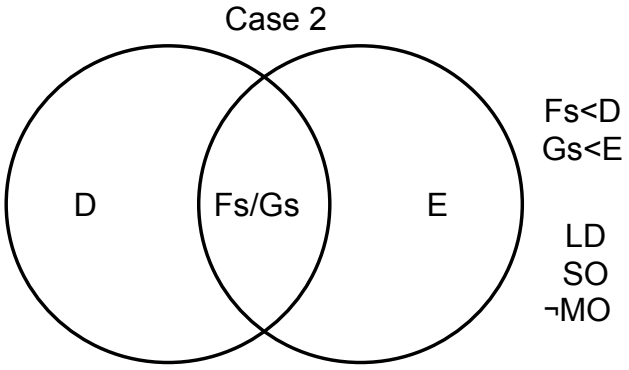


[25] I'm boldly making this claim, and am not saying much to back it up. You can interpret this part of the paper as a conditional: *if* you think this sort of case is possible, you face a puzzle. I think one reasonable response to this sort of case is to say that it is impossible; even if you think extended simples can colocate uncrowdedly, you might think they can't spatially merely overlap uncrowdedly. For these theorists, the gunk and hybrid cases in the next subsection may be more compelling. And those who reject the possibility of even those cases may avoid my puzzle altogether by being sufficiently restrictive about possibility. This is the response I prefer, and I discuss it in the final section of this paper.

[26] If you think it's implausible that any possible table like this would lack a middle third part, perhaps you may prefer a different example. E.g., a theorist may think only sufficiently natural objects and parts of objects exist, and some of those natural parts overlap without sharing a natural part in common. (Such as an object with a red part and a bumpy part, but where the red+bumpy portion isn't natural enough to be a part.) But if these examples aren't compelling, I recommend the gunk and hybrid examples in the next section.

Case 1 is intended to be an ordinary, everyday case of uncrowded spatial overlap. In this case, the objects liberally decompose enough to have some parts in common (LD), they spatially overlap (SO), and they mereologically overlap (MO).

- *Case 2:* D and E partially overlap in space. However, they do not share any parts, big or small. D and E are both liberally decomposable in much the same way A and B are: the largest region that is filled by both D and E is wholly decomposable into regions occupied by parts (the Fs) of D, and is wholly decomposable into regions occupied by parts (the Gs) of E. But no parts of D are also parts of E. The shared region in this case contains twice as much as the shared region in Case 1.

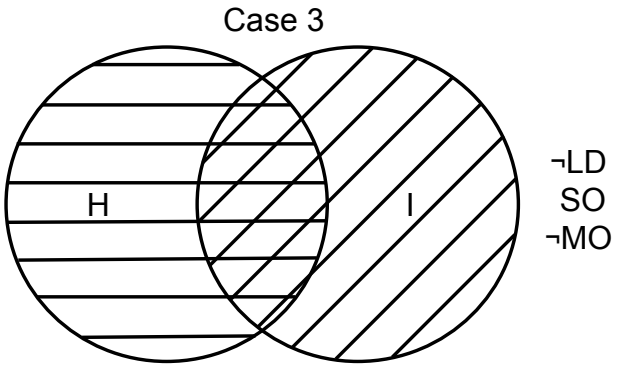


This second case is intended to be *just like the first*, except that the objects do not share any parts (and so there are more objects involved in this case). In this case, D and E liberally decompose and spatially overlap, but do not mereologically overlap. Intuitively there's overcrowding, though the case needn't involve any colocation: D and E are not colocated, and the Fs and Gs may not be colocated either.

- *Case 3:* H and I partially overlap in space. However, they do not share any parts, big or small. H and I have no proper parts at all: they are extended simples! Each of H and I is located at exactly one region; if there is a largest region filled by *both* H and I,[27] then that region is not exactly occupied by any object.

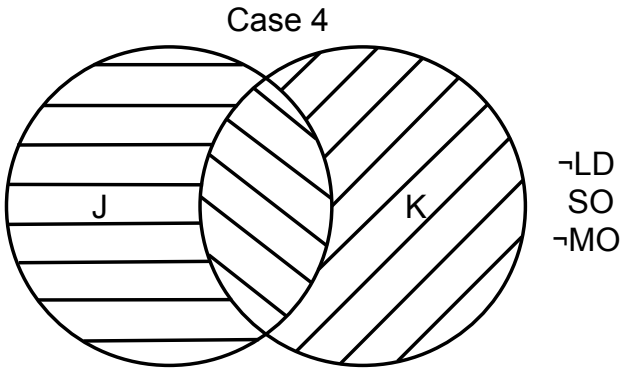
[27] Note that there may or may not be a largest region that both spheres fill. We can imagine a case where the extended simple spheres overlap in space that is liberally decomposable (e.g., decomposable into infinitely many point-sized parts, and also into various fusions of those point-sized parts); in such a case, there would be a largest region filled by both spheres (though neither sphere would have a part occupying that region). However, a case like this would also require that the mereological structure of objects occupying locations, and the mereological structure of those locations, are significantly different; for some region, *r*, the object that occupies it is simple, though *r* is not simple. Some may worry about the conceivability of such a situation, and my cases don't require any such differences between the structure of objects and the structure of locations. For instance, one may endorse the possibility of Case 3 by thinking it's possible for the case to involve extended simple (and overlapping) regions as well as extended simple objects. (Though I'm not sure it is easier to conceive of this.)

However, as with Case 2, there is a sense in which that region is overcrowded: it's filled by twice as much as we would've expected.



This case is intended to be *just like* the second case, but with the proper-parthood relations "erased" (and without the objects that were the proper parts of D and E). Consider again the case of you colocating with Casper when you both have a lot of parts, and the similar case where you colocate with Casper even though you're both simple. In thinking about how those cases compare, it's as if we've simply removed all of the proper parts from our ontologies while keeping everything else about the objects (their sizes, shapes, masses, constituting stuff if there is any, etc.) the same. My thought is that there'll be something like this kind of similarity between Case 2 and Case 3. Case 3 is just like Case 2 without all of D and E's proper parts, but absolutely as much as possible held fixed otherwise.

- *Case 4:* J and K partially overlap in space. However, they do not share any parts, big or small. J and K have no proper parts at all: they are extended simples. Each of J and K is located at exactly one region; if there is a largest region filled by both J and K, then that region is not exactly occupied by any object. But, just as in Case 1 (and unlike Case 2 and Case 3), no region is being "doubly filled". We are not packing twice as much into any amount of space.



This case is intended to be very similar to Case 1, in the same way that Case 3 is very similar to Case 2. Just as Case 3 is just like Case 2 but without the multitude of objects that are proper parts of the two spatially overlapping objects, Case 4 is intended to be just like Case 1 but without the multitude of objects that are proper parts of the spatially overlapping objects.

This is to say: consider the case of crowded spatial overlap between you and Casper. It seems you and Casper are crowded, collectively filling the same region twice-over, regardless of whether you each have many parts or only a few, or even if you're simple. Case 2 is intended to be a version of this case where you each have lots of proper parts, and Case 3 is intended to be a version of this case on the other end of the spectrum, where you're both simple. But among the similarities between the two cases is that they both seem to involve crowded spatial overlap. The current thought in relation to Case 4 is this: consider now the case of uncrowded spatial overlap between a the left two-thirds of a table and the right two-thirds of the table. Those two portions of the table collectively fill the middle region just once-over, and this seems to be the case regardless of what sorts of smaller parts the two table-portions have. Case 1 is intended to be a version of this case where each table-portion has lots of proper parts, and Case 4 is intended to be a version of this case at the other end of the spectrum, where they're both simple. But crucially, my claim is that if we think something like Case 4 is possible, and we think it's as similar as can be to Case 1 in spite of differences about how liberally the relevant objects decompose, then it will be like Case 1 in that it involves uncrowded spatial overlap.

Here's how this causes a problem. If Case 3 involves crowded spatial overlap, and Case 4 involves uncrowded spatial overlap, but the overlapping objects in both cases are all simple, we cannot appeal to a difference in sharing of proper parts to explain the difference between the cases in the sort of spatial overlap instantiated. And more broadly: the mereological features seem to be exactly the same between the two cases, so if the cases differ with respect to whether crowded or uncrowded spatial overlap is instantiated, we will not be able to appeal to mereology to give a complete explanation of it. That means that the solution from Section 2.2 that appealed to part-sharing (where we appealed to symmetric parthood with distinctness) will also be unhelpful here. Further, because neither object in either Case 3 or Case 4 seems to constitute the other, appealing to that relation will be similarly unhelpful. So, if we think some pair of cases like Case 3

and Case 4 are possible, and that they differ with respect to whether the spatial overlap involved is crowded or uncrowded, we need to explain this difference. And we cannot explain it completely via appeal to mereology or (whole[28]) constitution. This is the Overlap Problem.

Before moving on to other cases that generate the problem, let me note first some worries one may have at this point, especially in trying to understand Case 4. There are a number of questions one may have. For instance, it's not clear that Case 4 will be as similar to Case 1 as I'm claiming, given the differences between the cases with respect to proper parthood features. It can also be hard to have intuitions about features of (and even the possibility of) cases involving extended simples; we might find it hard, for instance, to think about how extended simples relate to the subregions they span over when they have no proper parts standing in *any* locative relations to those regions, and I'm asking us to think about exactly that when I ask us to think about whether they overlap crowdedly or uncrowdedly. Finally, it may not be clear what I intend when I say the spatially overlapping objects only fill the region "once-over": if we can't appeal to shared parts to understand this, what content might the phrase have?

One source of the difficulty in understanding Case 4 may come from the very feature that generates the Overlap Problem: the case, if possible, involves uncrowded overlap without a sharing of parts. If you're very committed to a mereological understanding of uncrowded overlap, this case will seem impossible or even incomprehensible. And I think that insofar as we do find the case somewhat comprehensible, it's because we are already (occurrently or not) appealing to one of the solutions to the problem, or a general form of a solution. So we might use this to do a sort of backsolving, to reach comprehensibility of the case. To give just one example, I find Case 4 much easier to comprehend when I imagine being a stuff-theorist (as we'll discuss in Section 4). If there's some matter that constitutes extended simples, and in Case 3 the simples are each constituted by their own matter and in Case 4 they share some constituting matter, that gives me a clear way to understand the difference between the cases and one way to understand what we may mean by the objects filling the shared region "once-over" in Case 4. Several of the solutions I'll discuss later can give us a

[28] I'll discuss appeal to a partial constitution relation below.

route into comprehending the cases. (Though the solutions come with costs, which is why I ultimately prefer rejecting the possibility of the cases.)

Finally, if the cases still seem inconceivable (perhaps because extended simples seem inconceivable, or using them in particular in these ways seems problematic), perhaps the gunk cases in the next section will be more appealing.

3.2 Spatially Overlapping Gunk

We can raise similar problems involving spatially overlapping gunk. For instance (to present cases exactly parallel to those in §3.1), take Case 1 and Case 2 to be as before. Let our gunky Case 3 be the following:

- *Gunky Case 3*: H and I partially overlap in space. However, they do not share any parts, big or small. H is gunky and all of its proper parts are one-dimensional and horizontally oriented. I is gunky and all of its proper parts are one-dimensional and vertically oriented. Each of H and I is located at exactly one region; if there is a largest region filled by *both* H and I, then the region is not exactly occupied by any object. However, as with Case 2, there is a sense in which that region is overcrowded: it is filled by twice as much as we would've expected.

So, for instance, if Case 2 involves you and Casper partially overlapping in space, Gunky Case 3 is intended to be exactly like Case 3 except that we're more restrictive about which parts you have: you are now made entirely out of one-dimensional, vertical gunky proper parts. And similarly for Casper, except that he is made entirely out of one-dimensional, horizontal gunky proper parts. But this added restriction on your and Casper's decompositions doesn't impact our thought that, when you overlap Casper in space, there's a sense in which the region in which you overlap is overcrowded.

- *Gunky Case 4:* J and K partially overlap in space. However, they do not share any parts, big or small. As with Gunky Case 3, J is gunky and all of its proper parts are one-dimensional and horizontally oriented, and K is gunky and all of its proper parts are one-dimensional and vertically oriented. Each of J and K is located at exactly one region; if there is a largest region filled by both J and K,

> then that region is not exactly occupied by any object. But, just as in Case 1 (and unlike Case 2 and Case 3), no region is being "doubly filled". We are not packing twice as much into any amount of space.[29]

The intention is that just as Gunky Case 3 is intended to be Case 2 with some additional restrictions on which parts the objects have, Gunky Case 4 is intended to be Case 1 with additional restrictions. And, the thought is, just as the restrictions did not impact our intuitions about overcrowding when applied to Case 2 and Gunky Case 3, the restrictions should not impact our intuitions about a lack of overcrowding in Case 1 and in Gunky Case 4. But here's a more intuitive way to think about what I'm after here. Suppose that the two objects in Case 4 are two parts of a single object. So we've got one object, like a table, and in the right two-thirds there are vertically-oriented gunky parts, and in the left two-thirds there are horizontally-oriented gunky parts. It's not as if, due to having this weird decomposition, the table somehow overcrowds or doubly-fills the middle third. And if the table is made of stuff, it's not like there's twice as much matter in the middle third. Instead, the same matter would make up some of the vertically-oriented parts of the right two-thirds of the table, and the same matter would make up some of horizontally-oriented parts for the left two-thirds of the table.

These cases are parallel to the extended simple cases in §3.1, but the decompositions I've described are not very plausible as actual possibilities. Here are some cases that produce the same difficulties, but which are more plausibly possible.

- *Crowded Tangential Gunk*: L and M are gunky, and decompose as liberally as you'd like. L and M partially overlap in space, but do so as minimally as possible: they are tangential discs (or whatever), occupying only a point in common. Neither has a point-sized part, and they do not share any parts in common. Even though none of L's and M's parts are colocated, the shared region in this case is overcrowded: it's filled by twice as much as we would've expected. If L and M are made of stuff, there's some stuff making up L and completely distinct stuff making up M, and the point-sized region is filled twice-over.

[29] This case was presented by Kit Fine in his Spring 2006 NYU Metaphysics lectures.

So, for instance, we can imagine that you and Casper are each gunky, and you spatially overlap only the smallest amount, occupying just a point of space in common. Intuitively, that point is filled twice-over, though no part of any object is exactly there.

- *Uncrowded Tangential Gunk*: N and O are gunky, and decompose as liberally as you'd like. N and O partially overlap in space, but do so as minimally as possible: they are tangential discs (or whatever), occupying only a point in common. Neither has a point-sized part, and they do not share any parts in common. Nonetheless, the shared region that N and O both fill is not "doubly-filled"; we are not packing twice as much into the same amount of space. If N and O are made of stuff, they are not made of distinct subportions at the shared point; the point-sized region is not filled twice-over by stuff.

This is like a gunky statue and a gunky portion of clay that just barely overlap. Intuitively, the region at which they overlap is not doubly-filled.

Finally, we can produce similar problems using hybrid-cases, similar to those described in §2.1. If you and Casper spatially overlap, but you are made entirely of point-sized proper parts and Casper is made of only extended parts, you will have no parts in common. And if a statue and a portion of clay partially spatially overlap (say, the statue is made of clay and metal), but the statue only has extended parts and the clay only has point-sized parts, the statue and clay will share no parts in common in spite of uncrowdedly spatially overlapping.

In each of these pairs of cases (one involving crowded overlap, the other involving uncrowded overlap), the members of each pair match one another with respect to (common) mereological, logical, and locative features of all of the entities involved. If we think these cases are possible, then, and we think there is a difference in the sort of spatial overlap involved, we will not be able to explain this difference via appeal to merely (common) mereological, logical, and locative features.

4. The Stuff Solution

There are many different kinds of responses to The Overlap Problem. In this section I'll focus on one response that is very natural, especially for an extended simples theorist: appealing to *stuff*. We can posit an ontological category of entities in addition to that of

things. Things are individuals that are typically picked out with count-nouns ('chair', 'atom', 'puppy', etc.). Stuff, on the other hand, is typically picked out with mass terms ('wood', 'coffee', air', etc.).[30] Stuff is typically taken to constitute objects: it is the matter of which they are made.[31]

If we have stuff in our ontology, we can use it to distinguish between the cases described in §3. In Case 1, the two objects spatially overlap, have shared parts in the region where they overlap, and also share some constituting matter in that region. In Case 2 the objects spatially overlap, but they have their own parts in the region where they overlap. Further, we might say they each have their own constituting matter in that region, too.[32] The region isn't merely overlapped by multiple objects, twice as much matter is fitting in the region as well. In Case 3 (and Gunky Case 3), everything involving the matter that constitutes the two overlapping objects is the same as in Case 2, except that subportions of that matter don't constitute as many proper parts of the objects as they did in Case 2. The nonexistence of shared proper parts of the two objects does not keep them from spatially overlapping, and it does not keep them from each having their own constituting matter present in the shared region. In Case 4 (and Gunky Case 4), everything about the constituting matter is the same as it was in Case 1, except (as with the move from Case 3 to Case 4) the subportions of the object-constituting matter no longer constitute as many proper parts of the objects as they did in Case 1. But the nonexistence of shared proper parts of the two objects does not keep them from spatially overlapping, and it does not keep them from sharing matter in the region that they both occupy. In Case 1 there was matter that made up the parts that were shared by the objects, and so that matter partly constituted both objects. In Case 4 (and Gunky Case 4), that matter still partly constitutes both objects; there is no coincident stuff in the region both objects fill.

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[30] Simons, *Parts: A Study in Ontology*, pp. 153-154. In what follows I'll sometimes talk about portions and subportions of stuff. I'll follow Markosian (2004) in taking 'portion of stuff' to simply be synonymous with 'some particular stuff'. Even though it is a count-noun, it is not intended to definitely refer to a thing. Instead, it is just intended to be a tool to help us more easily talk about particular stuff. So, for instance, when I say "two portions of stuff" that can be read as indicating that there's some particular stuff, and some other particular stuff. And if I say one portion is a subportion of another, this can be taken to mean that some stuff is some of some other stuff.

[31] Chappell (1973), p. 681. Here, constitution is taken to be a relation between stuff and things. If things can constitute stuff, and the relation is transitive, then things may also be able to constitute things. But even that sort of instantiation of the relation involves stuff.

[32] We may think that sharing parts and sharing constituting stuff come apart in a variety of ways: for instance, we may think two objects can share parts and fail to share constituting stuff, or that some stuff can constitute each of two things, one of which is part of one further object, the other which is part of some other further object sharing no parts in common with the first object. For the purposes of this paper, I will not take a stand on whether these things are possible.

More generally, if we posit stuff (and endorse a claim along the lines of: necessarily, every material object is constituted by some stuff) we can say that in every case of uncrowded spatial overlap, the spatially overlapping objects must be at least partly constituted by the same portion(s) of stuff. This, we can say, is also what sets uncrowded colocation apart from crowded colocation (of both simples and composites), as colocation is just a special case of overlap. We have an explanation of the difference between the two sorts of overlap that does not appeal to shared parts (and so is consistent with overlap cases involving extended simples and misaligned gunk), but which still respects our intuitions that the explanation should appeal to facts about whether the entities are made of something (or, more accurately, some stuff) in common. Uncrowded overlap involves a shared partial constituent.

Positing stuff is already a natural choice for the extended simples theorist. For instance, McDaniel (2003) raises the Problem of Spatial Intrinsics for heterogeneous extended simples. If a spanning extended simple is blue at one region and red at another, we want to say this is because it has a blue part and a red part. But it has no such smaller parts. Markosian (2015) responds to this puzzle by positing stuff: the extended simples theorist can say that the simple is blue at one region and red at another by being constituted by some stuff that has a blue subportion at one region and a red subportion at another. There are other responses to the puzzle as well,[33] but it's worth noting that, prior to the puzzle I'm raising, stuff can already do work for extended simples theorists.

My puzzle also bears some similarity to other pieces of motivation for positing stuff. Markosian (2015) presents multiple reasons why we may want to posit stuff if we restrict composition: For instance, he has us suppose we think Compositional Nihilism, the view that there are no composite objects, can be true even in a world in which there are no simples because any object that exists has proper parts. In such a world there will be no objects at all, but we might think it could still be "full" and look much like our world, and the possibility of stuff would help us explain this.[34] Markosian also presents similar motivation arising if we endorse Peter van Inwagen's restricted view of composition, on which the only things are simples and living entities.[35] Markosian also

[33] For instance, see Parsons (2004) and McDaniel (2009). For a version of this puzzle involving extended simple regions (ruling out responses that appeal to distinct regions at which the different properties are instantiated), see Spencer (2010).
[34] Markosian (2015), pp. 11-13.
[35] van Inwagen (1990), p. 82, and discussed in Markosian (2015), p. 14.

argues that we may want to posit stuff if we restrict fusion by denying that there is a fusion of everything, while still wanting to capture a sense in which the universe exists: we can posit a portion of stuff made of all other stuff. And more generally, Markosian notes that we may want to posit stuff if we accept restrictive views of when composition occurs, if such views require us to say there aren't things where intuitively there are some: we can appeal to portions of stuff to capture the intuition that the relevant entities exist. Insofar as my puzzle is seen as motivation for positing stuff, it can be viewed similarly: just as Markosian recommends using stuff to allow us to endorse the existence of entities that restrictions on composition would otherwise deny to us, in my cases stuff can allow us to endorse the existence of entities (namely, entities that partly make up each of two overlapping objects) that restrictions on decomposition would otherwise deny to us.

Okay, so much for reasons in favor of positing stuff in response to my cases. Now I'll briefly mention some reasons against it. I'll present these in order of increasing strength, with the third being among my own reasons for not endorsing the stuff solution.

First, the stuff solution may not be a good option for those who endorse the possibility of colocation largely in order to avoid positing stuff. Stuff is often invoked as a response to material constitution puzzles. For instance, you may claim that in the case of the statue and the lump, there is only one object in the region, the statue. And the object is made of some stuff, the clay. Since the clay is some stuff, it is not an object; it is of a different ontological category. So the stuff theorist captures intuitions that there are two entities in the region with differing persistence conditions, but without positing two objects exactly located there. And we are to be unconcerned with the coincidence of the object and the stuff it's made of, for that's exactly where we'd expect them to be in relation to each other.[36] But suppose a theorist attempts to avoid positing stuff, and so does not accept that solution to the problem of material constitution. They may thereby end up endorsing the possibility of colocation of objects. If such a theorist endorses the possibility of my cases in part because they endorse the possibility of colocation (though the puzzle raised in §3 does not actually require the possibility of colocation), if they end up endorsing a stuff solution to my puzzle they will undermine their own reasons for thinking my cases are possible. Of course, there are other reasons to think my cases are

[36] For arguments against the adequacy of positing stuff in order to avoid colocation, see Kleinschmidt, 2007.

possible, and there are other reasons to think colocation is possible. But this connection is worth keeping in mind.[37]

We should also note that in order for the stuff solution to be helpful in responding to my cases, we cannot think that similar cases can arise for portions of stuff. That is, for instance, it cannot be possible for there to be extended, simple portions of stuff that spatially overlap in crowded and uncrowded ways, or for there to be gunky, tangential portions of stuff that overlap in crowded and uncrowded ways. If these are possible, we will have to distinguish between the two types of spatial overlap in those cases, and we will no longer be able to appeal to shared subportions of stuff to do so.

Finally, here is the worry I take to be most troubling. In order for stuff to help us with our cases, we'll have to posit stuff that is not reducible to things.[38] Here's why we'll need irreducible stuff. If the facts about the things in Case 3 and Case 4 (and Gunky Case 3 and Gunky Case 4) are the same, facts about stuff that are reducible to those facts about things will not be helpful to us in distinguishing between the cases. If the facts about the things in Case 3 and in Case 4 (and Gunky Case 3 and Gunky Case 4) are not the same, then it is not clear why we cannot just appeal to those differences to explain the different sorts of overlap occurring in the cases. In order for stuff to be helpful, it must be adding something new that we can't get elsehow. But positing a new ontological category of stuff in addition to things is a huge ontological commitment.[39] We could posit stuff and take all things to be reducible to it – for instance, thinking that while it's true that Thales existed, he was just a portion of appropriately arranged water. Endorsing this sort of general view would avoid the need to have two independent sorts of entities in our ontology. But in doing this to help us distinguish between my cases, we would need to claim that there cannot be extended, simple portions of stuff that can overlap in crowded and uncrowded ways, or gunky portions of stuff that do not mereologically

[37] Another way of reading this is that everyone should like stuff: those who want to avoid colocation should posit stuff to help them do so. Those who are fine with colocation should posit stuff to help explain differences from weird possibilities that arise. This is not even close to a real dilemma, but it's a more stuff-friendly reading of how my puzzle relates to colocation puzzles.

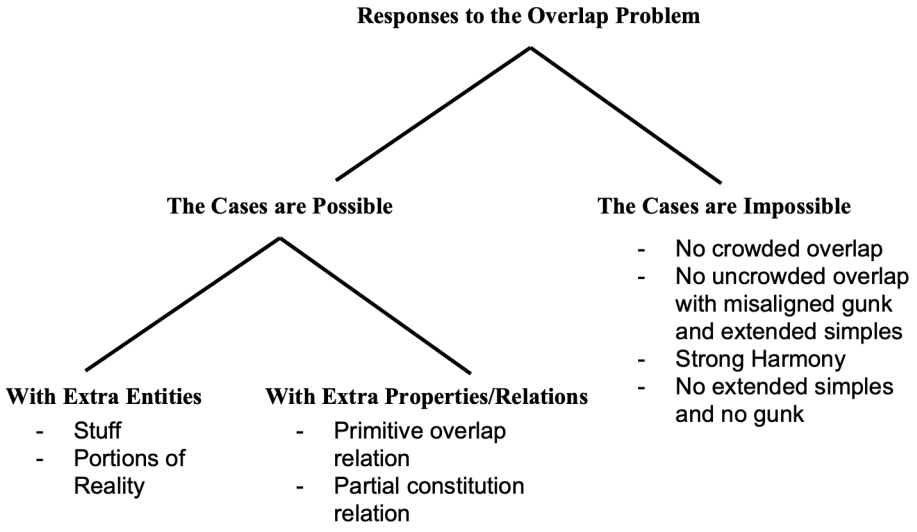
[38] See Markosian (2004 and 2015) for discussions of Pure Stuff Ontologies and Mixed Ontologies. Here, I'll take stuff to be irreducible iff (i) it exists, and (ii) there are facts about stuff that are not reducible to facts not about stuff. I'll take a kind of entity, *k1*, to be reducible to another kind of entity, *k2*, iff (i) entities of kind *k1* exist and entities of kind *k2* exist, and any facts about entities of kind *k1* are reducible to facts about entities of kind *k2*.

[39] Markosian (2015) responds to this worry by noting that stuff pulls its weight. For instance, in addition to his reasons for positing stuff that I've already mentioned, he argues that stuff seems to be part of our pre-theoretical picture of the world, and that translations of ordinary sentences about stuff into sentences about things don't adequately capture the meanings of the original sentences, indicating that we have reason to posit irreducible stuff.

overlap but which spatially overlap in crowded and uncrowded ways. But if we're going to respond to my cases by positing one fundamental kind of entity, and also endorse these restrictions on that kind of entity, I would prefer to have things play that role rather than stuff. At bottom, it may be a difference of intuitions: on the one hand, the stuff theorist can claim that liberal decomposition is much more plausible for portions of stuff than it is for things, so stuff is better suited to play that role.[40] But I also think it's overwhelmingly plausible that I exist as an individual and am a thing, rather than fundamentally as just some stuff.[41] And for me, that intuition is stronger than the intuition about decomposition.

5. Other Responses

In this final section, I am going to very briefly discuss a few of the many other responses to my cases. Responses will fall into one of the following categories: responses on which my cases are impossible as described, and responses on which they are possible and we explain the differences between them. Here's a non-exhaustive overview of many of the responses:



[40] Markosian (2015) notes that one of the advantages of positing stuff is that it provides us with a kind of entity that is plausibly governed by the rules of Classical Extensional Mereology. This allows us to keep the elegance of CEM and the intuition that some entities exist that follow its rules, while also allowing us to avoid counterintuitive consequences of things following these rules, such as the existence of a fusion of you and the Eiffel Tower. Similar considerations can apply to additional rules governing decomposition.

[41] A helpful reviewer pointed out that stuff theorists who take people to be portions of stuff will either have to claim that people can't be made of different portions of stuff at different times (which is a challenge if you reject Four-Dimensionalism), or they'll have to claim some portions of stuff do not have all of their subportions essentially.

The appeal to stuff was one way of endorsing the possibility of the cases and explaining the difference between them. Now I'll briefly discuss a few other ways of giving that sort of response.

In §1 when I initially discussed the difference between crowded and uncrowded occupation of regions, I mentioned that uncrowded occupation puts us at risk for double-counting in a way that crowded occupation does not. I mentioned Lewis's claim that we'll be double-counting if we count each of the cats and then the fusion of all of those cats: we will have counted the same portion of reality more than once.[42] Lewis was attempting to illustrate that there is a sense in which fusion is ontologically innocent: we can multiply things without multiplying portions of reality. Similarly, you might think that when you mold a lump of clay into a statue, you have created a thing but you haven't created a new portion of reality. What if we take talk of portions of reality seriously here? And what if, in addition to talking about identity and distinctness of portions of reality, we can talk about sharing reality?

Suppose we take facts about portions of reality to be independent of (or at least not reducible to) facts about things or stuff. We can invoke something like that notion of reality to distinguish between my cases: the entities in Case 4 (and Gunky Case 4) are, in part, the same portion of reality, whereas the entities in Case 3 (and Gunky Case 3) involve overlapping portions of reality. Of course, there are a lot of questions to answer. Are portions of reality really entities? If so, some of the same worries arise here that arise for portions of stuff. In particular, it looks like we have a new ontological category that's not reducible to things (though things may be reducible to it), and that's a significant commitment. And whereas with stuff we have a lot of evidence for its existence from ordinary language and theory, portions of reality seem harder to grasp. Finally, if we think things are reducible to portions of reality, the same objections I raised for stuff apply here: intuitively, I'm a thing. I don't really know what it means to say that, insofar as I exist fundamentally at all, fundamentally I'm a portion of reality.[43]

Another extreme way to add elements to our theory to distinguish between the cases is this: we can keep our ontology simple, but have a new relation entities can stand

[42] Lewis (1991), p. 81.

[43] There is a general strategy shared by the stuff solution and the reality response: to posit a new kind of entity, and claim that the difference between objects overlapping crowdedly and objects overlapping uncrowdedly comes down to a difference in how the objects relate to this new kind of entity. To play the role of a new sort of entity, we can appeal to portions of stuff, portions of reality, or something else altogether (such as properties).

in. For instance, we might posit a new overlap primitive. One way of endorsing this would be to take a non-ontological reading of our reality primitive. We might think there aren't really portions of reality, but sometimes entities $\text{overlap}_{\text{reality}}$. There might not be a thing or portion of stuff or any other sort of entity that they have in common, but they still overlap in some sense. What precisely we take $\text{overlap}_{\text{reality}}$ to be would be up to the theorist positing the new overlap relation. But it would need to be a kind of overlap beyond mere spatial overlap, and which doesn't require sharing of parts or a sharing of constituting stuff. The idea would be to capture our intuitions about reality-sharing without positing portions of reality. It would be a symmetric relation, and could be one-one, one-many, or many-many; we could say that the plurality of cats $\text{overlaps}_{\text{reality}}$ the fusion of all cats, the plurality sections of the book $\text{overlap}_{\text{reality}}$ the plurality of chapters of the book, the statue $\text{overlaps}_{\text{reality}}$ the clay, and the objects in our uncrowded overlap cases $\text{overlap}_{\text{reality}}$.

A second way of distinguishing between uncrowded and crowded overlap via appeal to a new relation is this: we can posit as our new "overlap primitive" a *partial constitution* relation, where two objects can stand in the relation even if they do not share any parts or portions of stuff in common. The thought here is that, for instance, two overlapping simples might be said to *partly constitute* one another when each is, in some sense, *at least some of* what makes the other up, even if neither has a part or a portion of stuff that is also a part or portion of stuff of the other. We can take the partial constitution relation to be asymmetric or not, as we prefer. And we can take it to be more restricted in its application than the $\text{overlap}_{\text{reality}}$ relation might be. For instance, we might think that the constitution relation must be one-one, so the plurality of cats won't constitute or partly constitute the fusion of all cats. All of this is up to the theorist who wants to posit the new relation.

There are several worries with any response like this that involves positing an extra primitive. One worry is that it complicates our theory dramatically: we have what appears to be a new relation that's not reducible to any others (or at least, not reducible to mereological, logical, and locative facts), and we cannot define those other relations wholly in terms of it. It seems strange that we would be unable to explain what it takes for entities to stand in the $\text{overlap}_{\text{reality}}$ relation, or in the partial constitution relation. Relatedly, there's the worry that we may end up with some strange possibilities (for instance, entities sharing parts without $\text{overlapping}_{\text{reality}}$), or we'll have a huge cluster of

unexplained necessary correlations (for instance, the impossibility of the strange situation just mentioned).

There are some less-strange, and less ontologically or theoretically costly, ways to respond to my cases. One is to take the cases to be impossible. For instance, we may deny that entities can even possibly overlap in crowded ways. And though denying the possibility of all uncrowded spatial overlap is implausible, one may more restrictedly deny the possibility of certain sorts of instances of it. For instance, one may endorse the possibility of extended simples or gunk and deny that extended simples or gunk with misaligned parts can overlap in uncrowded ways. This is a potentially promising line of response, though it will require giving principles supporting where the lines of impossibility are to be drawn.

Alternatively, we can endorse constraints on what regions can be like, together with harmony principles strong enough to rule out the possibility of the sorts of cases that produce this problem. For instance, we can require that any time an object extends through a region, it contains parts within every subregion of that region. As long as we can't have spatially overlapping extended, simple regions of space, this will rule out cases involving extended simples that merely partly spatially overlap. If, in addition to the first harmony principle, we also endorse a principle stating that any part of a wholly material object is located at a subregion of the region occupied by the whole, we will also rule out cases involving overlapping extended simples and gunk, and overlapping gunk and points. Finally, if we think that we cannot have regions wholly decomposable into misaligned gunky parts, a strong harmony principle will rule out our cases of overlapping, gunky objects.

Finally, the response I endorse: we may simply reject the possibility of extended simples and of gunk. For instance, though we might say there is some restricted sense of 'thing' or 'object' on which there can be an extended simple (if the entities we took to be its proper parts don't count as *things* or *objects* in the restricted sense, and if we think counting as things or objects in that sense is required for them to be parts), if we set aside those restricted senses and talk unrestrictedly, there will be objects that are shared as parts of any two entities that overlap uncrowdedly. Just as the stuff solution and reality-portion solution attempt to give us an ontological category of entities that cannot be restricted in their decomposition enough to be extended and simple, we may think that

the most general senses of 'thing' and 'object' are like that. We don't need a new ontological category to find this kind of entity. And against the possibility of gunk, we may think that if gunk is possible, it is possible to have gunk such that every part of it has some continuous, extended part. But this kind of gunk is ruled out by our supplementation axioms.[44] Of course, rejecting the possibility of extended simples and of gunk is controversial, and it doesn't solve the colocation problem for point-sized objects. But that problem is much easier to solve.

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[44] See Kleinschmidt, 2016.

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