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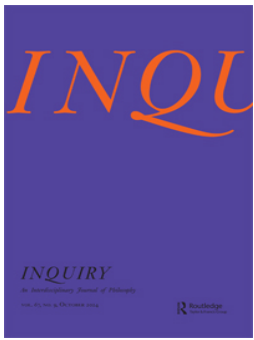
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In defense of disjointism

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ABSTRACT

Disjointism is the view that co-located objects do not share any parts. A human-shaped statue is composed from a torso, head and limbs; the co-located lump of clay is only composed from chunks of clay. This essay discusses the tenability of this relatively neglected view, focusing on two objections. The first objection is that disjointism implies co-located copies of microphysical particles. I argue that it doesn't imply this and that there are more plausible disjointist views of tiny parts available. The second objection is that disjointism is at a loss to explain how material objects can be co-located and why the weights of co-located objects don't add up. The standard pluralist account appeals to the fact that co-located objects stand in mereological relations and this account is not available to the disjointist. I sketch an alternative account that appeals to a notion of 'material identity': the statue is taken to be the same matter as the lump of clay. The resort to a new theoretical primitive may seem to invite a quick rejection on grounds of unnecessary theoretical complexity but I argue that an abductive comparison with rival forms of pluralism shows that such a rejection is misguided.

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1. Introduction

Pluralism is the view that there can be co-located material objects. The classic illustration of the view is in terms of a statue and the lump of clay from which it's created (Gibbard 1975). An artist puts bits of clay together into a single lump and, after some planning, forms a human-shaped statue out of it. The lump of clay is plausibly distinct from the statue because the lump existed before the statue and the lump survives deformations that would destroy the statue. The statue, in its turn,

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survives losing a few parts, which would arguably destroy the lump. The differences in temporal and modal properties seem genuine and, according to pluralism, they suffice for these objects to be distinct.

Disjointism is a form of pluralism that holds in addition that *ordinary material co-located objects*, such as the statue and the lump, are entirely mereologically disjoint: they share no parts whatsoever.¹ There is no single plurality that composes two distinct co-located objects. As I understand it, the view is exclusively about the composition of ordinary material objects. This category is of course loosely specified (after all, what is it to be 'ordinary?') but it will do for our purposes and suffices to identify the view that has come under some attack: the view that ordinary co-located objects are mereologically disjoint.

To illustrate the view, consider the plurality consisting of the torso, the head, and the four limbs of the statue and compare these to the plurality consisting of the torso-shaped chunk of clay, the head-shaped chunk, and the four limb-shaped chunks of clay. The torso may well have come into existence later than the torso-shaped chunk of clay and this torso-shaped chunk would survive deformations that would destroy the torso. Hence, the torso isn't identical to the torso-shaped chunk of clay. Similarly for the head and the limbs: they aren't identical to the co-located chunks of clay. The plurality of chunks of clay is therefore distinct from the plurality consisting of the torso, head and four limbs. It's natural to assume, moreover, that the statue is composed from the torso, head and limbs and not the corresponding chunks of clay, whereas the big lump of clay is composed from the smaller chunks of clay and not the corresponding body parts of the statue. Disjointism assumes that this holds generally: distinct but co-located pluralities of parts compose distinct but co-located ordinary objects.

Note that disjointism is in line with the extensionality and uniqueness principles (which I will simply call the 'extensionality principles'):²

Extensionality: if x and y have the same proper parts, then $x = y$.

Uniqueness: if x and y are composed from the same plurality of things, then $x = y$.

¹Wasserman (2002) calls disjointism the '*no coincidence*' view. I haven't adopted this label because 'coincidence' is ambiguous between spatial coincidence (co-location) and mereological coincidence (mereological overlap). Some also use '*the coincidence view*' for the general view that I've called pluralism. The label of '*no coincidence view*' can therefore be a little confusing: disjointism is a form of pluralism and accepts spatial coincidence.

²As Varzi (2008, 109) notes, some treat uniqueness as the extensionality principle (van Inwagen 1990, 39; Lewis 1991, 74; cf. Rosen and Dorr 2002, 153–4).

The contrapositives of these extensionality principles say, respectively, that distinct objects cannot have the same proper parts and cannot be composed from the same plurality of things. Disjointism is the natural view that results from accepting pluralism as well as the *extensionality* of parthood and the *uniqueness* composition: co-located objects are distinct objects that do not have the same parts and aren't composed from the same things.

Disjointism is relatively neglected in the literature – but there are exceptions. The view is critically discussed in Wasserman (2002, 199–202) and, more briefly, in Walters (2017, 28–9). A closely related view is discussed in Paul (2006, 628). Two main concerns emerge in these discussions. I will formulate them in my own terms. The first concern is that disjointism implies a rather objectionable view about the tiny parts of objects (and by 'tiny', I mean as tiny as the microphysical particles). I argue in section 2 that the disjointist can adopt less bizarre views of the tiny parts than the one that is taken to be implied by it. The second concern is that disjointism is unable to explain why the weights of co-located objects fail to add up and how material objects can be co-located. The standard pluralist account of this appeals to the fact that co-located objects stand in mereological relations – which is of course precisely what disjointism denies. Disjointism needs a different story. I sketch such a story in section 3 and defend the alternative account against potential objections on abductive grounds in section 4.

Before Wasserman (2002) raises these objections, he also points out an argument in support of the view. Disjointism seems to have a unique advantage over rival pluralist views in the way that it can address, or even avoid, the so-called grounding problem (2002, 201). The grounding problem is the challenge for pluralism to account for the difference in the modal profiles and the natural or social kinds they fall under, given that the lump and the statue have the same intrinsic properties, the same shape, same mass, same colour, and so on, as well as the same relevant extrinsic properties, such as standing in the same causal and spatial relations to things around them (see amongst others, Simons 1987, 225–6; Heller 1990, 30–2; Burke 1992; Zimmerman 1995, 87–8; Fine 2008; Paul 2010).

My own preferred way to understand the grounding challenge goes as follows. Focus on kinds for the moment. It's fairly plausible that there are sufficient conditions for falling under some kind. Merely walking and talking like a duck may not suffice for being a duck but having an internal physiological structure exactly like that of a duck, the relevant organic

parts in the relevant functional configuration, may well suffice for being a duck (given that this implies the ability to produce fertile offspring with a fellow duck, for example). However, if two co-located objects are built from the same things and are more generally intrinsically alike, it's hard to see how one object could meet the sufficient conditions for falling under some kind while the other doesn't. Whatever it takes to be a lump of clay, why does the statue fail to have what it takes to be a lump? In the other direction, whatever it takes to be a statue, why does the lump fail to have what it takes to be a statue as well?

Wasserman points out, correctly, that the grounding challenge doesn't obviously apply to disjointism (2002, 201). On this view, there *will* be relevant intrinsic differences between co-located material objects, such as the lump and the statue, namely their intrinsic mereological structure. Indeed, as the view will be developed here, typically wholes aren't just composed from distinct things but even from different *sorts* of things. The lump is composed from smaller lumps of clay, the statue isn't. Assume that it suffices for being a mere lump of clay that an object is composed of smaller lumps of clay that are squished together, then it's straightforward to see how the statue doesn't meet this sufficient condition: it isn't composed of smaller lumps of clay squished together. Assume that it suffices for being a statue that an object is composed of a torso, head, and limbs that were intentionally stuck together so as to form the shape of a body (needless to say, this won't be a necessary condition for being a statue, only a sufficient one), then it's again straightforward to see how the lump of clay doesn't meet this sufficient condition: it isn't composed of these sorts of parts stuck together in an intentional manner by some artist. The grounding problem is premised on an apparent intrinsic (or 'categorical') similarity of co-located objects, and so the problem – at least as standardly formulated – doesn't get off the ground, as there *is* a relevant intrinsic difference.

Although it will be important to keep this potential advantage in mind, I won't discuss it further in what follows. A more detailed discussion will quickly fill the space of a paper – given the extensive discussion of the grounding problem in the literature. Besides its distinctive take on the grounding problem, I think that there is *prima facie* support for disjointism in the plausibility of endorsing an extensional mereology with regard to the parthood structures exemplified by ordinary material objects. This latter point will surface in the final section of the paper but only briefly. The main focus is solely on the two main objections that I mentioned, concerning the supposed duplication of tiny parts

and the non-additivity of co-located objects. Given that the starting point is an apparently universal rejection of the view, my aims are modest. The aim is a first serious stab at defending the view, to the point that further work on the view seems justified. I hope the reader sees that the apparently devastating objections to disjointism are not nearly as conclusive as they may initially seem. The replies to the objections will rely however on views that are only sketched for dialectical purposes and need to be further developed. Along the way, the discussion touches on issues concerning the relation between the microphysical and the macrophysical (and, further in the background, between the scientific and manifest images of the world) as well as our conception of what it is for things to be material.

2. Bizarre tiny parts?

According to disjointism, there is no single plurality that composes distinct but exactly co-located objects, so when there are multiple exactly co-located macroscopic objects, any plurality of microphysical particles in the occupied region could at most be part of one of them. It might seem that there would have to be co-located copies of each microphysical particle, one copy for each co-located macroscopic object. As Walter remarks: '[T]he part of the statue that looks like a small piece of clay or an atom is in fact a distinct thing that is coincident with the piece of clay or atom' (2017, 28). This doesn't seem right. Moreover, as Wasserman notes, manipulating some clay brings a statue into existence, but we don't think that such activity also brings into existence a host of additional microphysical particles as well (2002, 199). These concerns may seem quite devastating. The microphysical particles that we currently know about don't just pop in and out of existence in this way. If disjointism implies that they do, disjointism is straightforwardly in conflict with current microphysics and should be rejected.

The view that there are co-located copies of microphysical particles, at least one copy for each co-located macroscopic object, is indeed rather implausible. But disjointism doesn't imply this view of tiny parts. I think that disjointism should opt for an alternative view of the tiny parts of (co-located) objects. This alternative view, I admit, remains revisionary but is to my mind hardly as objectionable as the view targeted by this objection.

Note first of all that nothing in disjointism directly entails that there will be co-located microphysical particles (one set of particles for the statue,

and one set of particles for the lump), nor any view about how the tiny parts come into existence. Consider first bigger parts of some arbitrary size and shape. What is this part of the statue that is the size of this arbitrary region here? Answer: it's a bit of statue with that arbitrary shape and size, occupying that oddly shaped region. It's more or less what the statue is like in that region. This is the best answer that we can give for most of the parts because most of the parts do not fall under any interesting sortals. The disjointist (and, in fact, everyone else too) should at least accept the answers that continue to take this (uninformative) form as we go smaller. What is this part of the statue that is the size of this tiny 1 mm thick sliver around the ear? Answer: it has to be a bit of statue of that sliver-thin shape and size, at that location (assuming that there is such a part; see below). We can go even smaller: what is this part of the statue that might be the size of a molecule, at location x, y, z ? The answer: a bit of statue, of that particular tiny size, at that location. Tiny parts are in the first instance just like other arbitrary and uninteresting parts of the statue, only tinier. Disjointism doesn't imply any further view about them.

This applies also to questions about how these tiny parts come into existence. Any tiny parts that come into existence when the statue is created are just like the other parts that may come into existence when the statue is created, only smaller. There is again no general story implied about the creation of these parts. When the statue is brought into existence, so might be the head, torso, arms and legs. But this might also not be the case; perhaps we first create the head, torso and limbs and only then create the statue by sticking these together. What goes for big parts, goes for smaller parts, and differs on a case-by-case basis and the sorts of parts we're talking about. There is no general story to be given about the creation of the parts of wholes, nor is disjointism committed to any such story and, I stress, nor is any other theory of co-located objects committed to such a story about the bigger arbitrary parts of macroscopic objects. Disjointism is compatible with the view that there might not be any interesting or informative general view to be had of the tiny parts of co-located objects beyond the negative claim that they are not microphysical particles (given what we know about the way these come into existence and interact).

Not only is disjointism neutral with regard to a specific view about the tiny parts, it is even compatible with the view that an ordinary material object, like a statue, lacks the relevant super-tiny parts altogether, being instead composed from so-called (spatially) extended simples.

We call an object a mereological simple when it has no proper parts. Extended simples are mereological simples that occupy a region that includes more than one point in space (see, amongst others, Markosian 1998; Simons 2004; Braddon-Mitchell and Miller 2006; and McDaniel 2007, 2009; from here on, when I say ‘region’ I mean a non-point-sized region). One could think that statues require parts that have a substantial shape and colour, perhaps still roughly visible to the naked eye, and that they therefore must be of some substantial minimal size. The statue would then be composed of extended simples and hence lack parts that are exactly co-located with microphysical particles.

More generally, disjointism allows that the mereological structures of co-located objects can come apart in all kinds of ways. We call an object gunky when *any* proper part of an ordinary object is composed of further proper parts (Lewis 1991, 20). To illustrate a potential case in which mereological structures come apart: the lump of clay could be gunky whereas the statue is composed from mereological simples.

Disjointism may even help alleviate certain worries about extended simples. Disjointism is congenial to the idea that ordinary material objects are composed of extended simples even in cases where the space they occupy is complex and not an ‘extended simple region of space’ (see Braddon-Mitchell and Miller 2006). The idea of an ‘extended simple’ can be odd, as it seems that we can always mentally divide a complex region of occupied space and consider the occupants exactly located at those sub-regions (cf. Markosian 1998, §VI). If an extended simple is co-located with an object that is either gunky or composed of point-sized mereological simples, we can accommodate this to some extent: if you consider the region of space that the putative extended simple occupies, and you consider some sub-region, there would indeed be occupants of these sub-regions, only they would not be parts of the extended simple, they would merely be sitting in sub-regions of the region occupied by the extended simple.³

The offered non-committal response is however not by itself enough to lay the general worry about tiny parts to rest; I think there is a further

³In other words, we distinguish two theses. One thesis says that for any mereologically complex (i.e., non-simple) region of space, *all* objects that are exactly located at it are similarly complex. A weaker thesis holds that, for any mereologically complex region of space, there is *an* object that is exactly located at it that is similarly complex – leaving room for the possibility that a complex region is *also* occupied by a mereologically simple object. Disjointism conflicts with standard formulations of general mereological harmony (see the biconditionals in Uzquiano 2011, §2) but there might be weaker formulations of mereological harmony along the lines of ‘any mereological structure on space is mirrored by *at least some* objects located at it’, which are compatible with disjointism.

implicit issue that needs to be addressed. We standardly assume that zooming in on an ordinary macroscopic object gives us a better look at the tiny parts of that object. If I take the statue, place it under a (large!) electron or atom force microscope and zoom in, I will see things that 'look like' clay particles or molecules. Given the assumption that a microscope gives us a better look at the tiny parts of anything that we place under it, disjointism would indeed imply that the statue must have tiny parts that at least 'look like' (or *are* like) clay particles or molecules, or else fly in the face of the epistemic evidence provided by our microscopes.

The disjointist should reject the assumption that a microscope always gives us a better look at the tiny parts of anything that we place under it. On the assumption of pluralism, there is a stronger and weaker formulation of this 'zooming-in assumption'. The stronger assumption is that a microscope always gives us a better look at the tiny parts of *every* object that we place under it (i.e. every object that exists in the spatial region that we are looking at). The weaker assumption is that a microscope always gives us a better look at the tiny parts of *at least one of* the objects that we place under it (i.e. we always see parts). Disjointism only needs to reject the stronger assumption. Zooming in on a region occupied by something does not always give us a better look at the tiny parts of every macroscopic object in that region. When you try to 'look more closely' at the molecule-sized part of the statue through a microscope, you won't end up with a better look of the relevant tiny parts of the statue at all, you will end up looking at something else, namely a molecule, which is the tiny part of something else that is collocated with the statue. The statue *and all its parts* go out of view at some level of magnification. Anything that 'looks like' or *is* like those molecules simply isn't the sort of thing that composes a statue.

The general picture that emerges from this is a more radical separation of the microscopic and macroscopic manifestation of the world, severing the parthood relations that we ordinarily assume between them. This may not be so implausible as one may think. We tend to forget how extraordinary the microphysical particles really are. Focus on their weirder characteristics and it should really not be so obvious that we can naturally take these things to compose ordinary material objects. We know that even our talk of microphysical tiny objects may already turn out overly simplistic. As the popular science goes, microphysical 'particles' behave partially as waves, can lack precise locations and come entangled with particles far away. If these things are better not seen as particles at all at some level of

magnification, then that may independently call for a restriction on the zooming-in assumption. At the very least, microphysical particles are in many ways unlike the ordinary things that surround us. So much so that it shouldn't be evident that strange 'particle-cum-waves' are apt to compose the type of objects to which we can attribute the ordinary spatial, temporal and modal profiles of the objects around us.

To flesh this out, consider a well-known issue about the solidity of objects (going back at least to discussions in Eddington 1928, 342 and Stebbing 1937). The atoms found within the region occupied by the statue and the clay occupy very little of the region that falls within the spatial outlines of the macroscopic objects (according to the popular science, 99.999999999999% of the space occupied by an atom can be considered 'empty'). One would think that these atoms compose something that should itself occupy only a tiny percentage of the spatial region within the spatial outlines of a macroscopic object. That is to say, it is plausible to assume that, necessarily, if no member of a plurality is weakly located at region *R*, they do not compose an object that is weakly located at *R* either – a whole inherits its location from the locations of its composing parts (Uzquiano 2011, 208).⁴ Composition does not magically generate new locations for the wholes beyond the locations of the parts. The sub-atomic particles aren't located at 99.99% of the region that we *do* ordinarily take to be occupied by the ordinary objects around us. Neither the statue nor the clay is a highly scattered object, nor one that is virtually empty. They are solid objects that, roughly, fill up the region that they occupy.

Of course, an alternative response to these empirical facts is to revise our conception of the ordinary objects around us. Perhaps the objects around us *are* highly scattered objects, one might think, and fairly so. This is a reasonable response to the empirical facts we discovered about atoms but note that, either way, some serious revisions need to be swallowed, roughly: we either (1) reject the inheritance of locations from composing parts, or (2) we revise our assumptions about what is part of what, or (3) we revise our assumptions about the spatial profiles of objects. Disjointism revises what is part of what; standard forms of pluralism need to reject either the inheritance of locations from composing parts or revise the spatial profiles of objects. There just isn't a non-revisionary option here. To reject any view here just because it's revisionary is misguided. Note in particular that revisions in the spatial profile of

⁴Something is weakly located at some region *R* iff *R* is not entirely free from it (Parsons 2007, 203).

ordinary objects sit uncomfortably with the motivations that drive pluralism: if we revise the spatial profiles of the macroscopic objects to match the spatial profiles of the composing parts, why not also revise the temporal profiles and modal profiles to match that of the composing parts? Pluralism is motivated by a conservative approach to temporal and modal profiles and this naturally extends to spatial profiles. Indeed, can we safely assume that a highly scattered or non-solid statue still has the modal profile that we ordinarily attribute to it? Can such a thing even *be* a statue?

So, some revision seems anyway forced on us if we are to make sense of the relation between the microscopic and macroscopic, and rejecting the zooming-in assumption is one of the potential approaches to this tricky issue that we should take seriously. The harder question for this approach is what underwrites the rejection of the zooming-in assumption. *Why* do the macroscopic objects and all their parts go out of view? Let me sketch two possible answers (without suggesting that there are no other views).

One possible account of why, when zooming in, certain macroscopic objects may go out of view is that a microscope is only a device for detecting *specific* kinds of tiny objects, namely those that enter *directly* in the physical interactions that underlie the workings of the microscope. For example, we can accept that the beams of electrons of an electron microscope bounce off small particles of particular sorts, namely the microphysical particles we know and love. Of course, this might make the macroscopic stuff seem odd and ghostly but this can easily be overstated. On a standard view, we also hesitate to say that tables interact themselves directly with electromagnetic fields, they arguably don't, it's the microphysical particles that engage in this interaction directly and this just explains how the macroscopic object is the way it is. The disjointist view isn't much different. The disjointist doesn't deny the existence of the microphysical particles, nor their trajectories, nor the interactions they engage in, nor explanations in terms of them (a point that I will discuss in more detail below). The disjointist doesn't disagree with the standard physics governing these particles. Disjointism only denies that these are part of the statue.

Another, more radical approach as to why, when zooming in, macroscopic objects may go out of view is by accepting that what we call different scales are really a type of 'metaphysical standpoint' relative to which different facts obtain – there are substantive microscopic and macroscopic 'levels' of reality. This is suggested by popular talk of

microscopic and macroscopic ‘worlds’. Just as an object may exist from the standpoint of one moment in time but not from the standpoint of a later moment, so one might think that there only exist molecules and no ordinary macroscopic objects at a microscopic level and that there exist only macroscopic objects and no molecules at a macroscopic level. Zooming in is like adopting a certain standpoint, namely one relative to which only facts involving microscopic objects obtain and hence, relative to which only those facts are observable. This variation across scales can be understood on the model of variation across time: observing things at a later moment in time makes one adopt a standpoint relative to which only later facts obtain and only those later facts are observable. We don’t see the macroscopic object because it isn’t there from the perspective of the microscopic scale. The proposal is that there are differences in what facts obtain and what objects exist across scales, in the same way that there are differences in what facts obtain and what objects exist across time.

Disjointism doesn’t imply that co-located objects have co-located copies of the tiny microphysical particles, which is not the most plausible view of the tiny particles for the disjointist to adopt. Disjointism is not committed to any particular view about the tiny particles, nor does it even imply that macroscopic objects have super-tiny parts in the first place. To reject that something like the microphysical particles is part of ordinary objects, and that we always see the tiny parts of something that we zoom in on, offers an admittedly revisionary conception of the relation between the microphysical and the macrophysical, and of what is part of what, but any comprehensive story is bound to be revisionary in other ways. I outlined two ways to make sense of why microphysical particles are not part of some of the ordinary material objects. There may well be other ways.

There is still a further question. Although disjointism doesn’t deny the existence of the microphysical particles, nor the scientific facts about how they interact, one might worry that, by denying that they are part of macroscopic objects, the disjointist must give up on certain explanations in terms of the tiny particles and the parthood relations they stand in. This is a variation on a more general worry, addressed in the next section.

3. Material identity

Let me turn to the second main objection to disjointism (Wasserman 2002, §2; Walters 2017, 28–9). The statue weighs 100 pounds and the

lump weighs 100 pounds. When we put them on a scale, it doesn't read 200 pounds but 100 pounds. Although they are distinct material objects, their weights don't add up (Lewis 1986, 252). The second main objection is, in short, that disjointism cannot give the standard account of how material objects can be co-located or of why their weights don't add up.

Pluralists point out that the weights of parts don't add to the weights of anything that they are part of (Zimmerman 1998, 293–4; cf. Zimmerman 1995, fn. 57). If a book weighs 10 pounds and its cover weighs 2 pounds, it would be a mistake to expect a scale to read 12 pounds. This non-additivity of parts needs to be recognized as a basic fact, or so they claim. Standard pluralism can explain the non-additivity of co-located objects in terms of this non-additivity of parts: just like the cover of the book doesn't add up to the book because of the mereological relations between them, the statue and the lump don't 'add up' because of the mereological relations between them. The objection to disjointism is that it cannot adopt this explanation because it denies that there are mereological relations between the lump and the statue. As Wasserman puts it, the disjointist seems 'at a loss when it comes to explaining why their mereological sum does not, in fact, weigh 200 pounds' (2002, 202).

The same goes for the fact that according to pluralism, material objects can share the same region of space. It's not generally the case that two material objects can occupy the same region. So, co-located material objects are special in some sense and the pluralist needs to offer an account of how co-located material objects can be co-located (Wiggins 1968). The answer, again, is that they can be co-located because of the mereological relations between them and, again, this account is not available to the disjointist.

In what follows, I will sketch an alternative account of the non-additivity of co-located objects. According to this conception, we take it as a basic fact that certain objects are the same matter as each other (a type of relation that has occasionally surfaced in previous discussions, often drawing on Aristotle's work, see Chappell 1971, 1973; Cresswell 1992; Zimmerman 1997; Rea 1998).⁵ The statue *is* the same matter as the

⁵Rea (1998) explores a view that revolves a notion of 'accidental identity' which is close to the notion of 'material identity' introduced here (and is similarly inspired by Aristotle's work). There is however a crucial difference in the theoretic work the notion does, as well as how the relation is conceptually understood. Rea is quite adamant that: 'Accidental sameness is not identity, but it is a kind of numerical sameness. [...] I take it that, necessarily, if *a* and *b* are numerically the same at a certain time, then *a* and *b* share all of their parts in common at that time. Accidental sameness, then, entails complete community of parts' (p. 322). Of course, the central assumption with regard to material identity as it is used here is precisely that material identity doesn't imply sameness of parts, or sharing of parts.

lump. We accept this as a basic fact that we can get a theoretical grip on without appealing to mereological relations, or any other kind of sharing of stuff. The idea is not that co-located objects 'share' the same matter. Quite the opposite: each material object counts as material on its own and not because of 'having' or 'containing' some matter. We reject this 'container view' of objects 'holding their matter' somehow. A material object doesn't *have* matter, nor is it composed from matter, rather, it *is* matter in and of itself and each *is* the same matter as objects co-located with it. The accounts we give of the non-additivity and co-location will be in terms of these basic facts. How can the statue and the lump be co-located? Because the one is the same matter as the other. How is it that the weights of co-located objects fail to add up? Again, their weights do not add up because they are the same matter. Weights only add up when they are the weights of distinct bits of matter and co-located objects are not distinct bits of matters, they are the same matter as each other.

Before discussing the tenability of this account, let us first have a closer look at this relation of *one thing being the same matter as* another, which I will call 'material identity'.

Material identity is not a form of qualitative identity, it doesn't just consist in the sharing of properties or kinds, such as sharing the kind *being a material thing*, it consists rather in being the same thing *in a certain sense* (compare Rea 1998). Material identity is an equivalence relation (at a time): (1) anything is the same matter as itself, (2) if x is the same matter as y , then y is the same matter as x , and (3) if x is the same matter as y , and y as z , then x is the same matter as z . I propose that material identity is expressed by the multigrade predicate ' $_$ is/are the same matter as $_$ '. The relation is naturally taken to be a multigrade relation because things are the same matter as any whole that they compose: the clay particles *are the same matter as* the lump.

Material identity relates pluralities to single entities given that composing parts are the same matter as the whole they compose. Because a plurality is many things and a whole is one thing, collections of proper parts and wholes are distinct things, material identity can hold between distinct relata. The disjointist assumes that the relation also holds amongst single co-located entities that are distinct, such as the lump and the statue. The relation is therefore not co-extensive with the tightest equivalence relation, numerical identity. We can

Moreover, the current view doesn't understand the relation as a kind of *numerical identity*, even though, as I will suggest below, we often count in terms of *material identity*.

think of it instead as an identity-like relation, not unlike relations of sameness of type or relations of relative identity (which is not to deny that there is absolute numerical identity, only to admit that there are *also* types of relative identity; cf. Gupta 1980).⁶ Compare it to *being the same book*: just as one copy can be the same book as another copy, one object can be the same matter as another object. Just as two copies can be numerically distinct manifestations of the same book (even though they differ in their covers, sizes, fonts, and so on), so co-located objects can be numerically distinct manifestations of the same matter (even though they differ in how many things they are, in what kinds of things they are, and so on).

A single proper part is naturally taken to be only *partially* the same matter as any whole that it's part of. The cover is *partially* the same matter as the book that it's part of. This relation of *partial* material identity is not an additional primitive but can be defined:

Partial material identity: x is partially the same matter as $y =_{df}$ some zz are such that x is amongst the zz and the zz are the same matter as y .

Put simply: x is partially the same matter as y whenever y is the same matter as some plurality that includes x . The cover is *partially* the same matter as the book because the pages and the cover are together the same matter as the book.

Objects that are the same matter *must* share various kinds of properties. We can use the metaphysical principles about such systematic sharing of properties to come to a better theoretical grip on the notion. One family of principles ties material identity to the sharing of quantitative properties. Consider, for example, the following principles:

Necessarily, if x is the same matter as y , then (x 's mass $m = y$'s mass n)

Necessarily, if x is partially the same matter as y , then (x 's mass $m \leq y$'s mass n)

Mass is here understood to be a physical *quantity* and is to be distinguished from the notion of matter. Being some matter concerns *what* something is. Being some quantity (of mass) is *how much* something is (and, of course, determines weight). The relation of being the same matter necessarily implies that the objects are the exact same quantity

⁶One feature that distinguishes it from numerical identity is that material identity doesn't hold eternally or necessarily. The river can be the same matter as some body of water and it can be the same matter as a different body of water in a few moments.

of mass as each other, they are *as much* as each other. Of course, the other direction doesn't hold: having the same quantity of mass doesn't suffice for being the same matter. Two things can both weigh 10 pounds and yet not be the same matter (indeed, one object might be in Hawaii and one might be here in my office).⁷

Another family of metaphysical principles connect mereological facts to material identity. Consider for example the following two central principles:

Necessarily, if the *xx* compose *y*, then the *xx* are the same matter as *y*.

Necessarily, if *x* is part of *y*, then *x* is partially the same matter as *y*.

The other directions will be a matter of controversy. In particular, as the disjointist understands the notion, material identity will not in general imply mereological relations. Needless to say, there are more principles concerning relations between mereological structure and material identity (and its partial counterpart).⁸

On the proposed view, material identity plays an important role in understanding how we count in ordinary contexts. When the statue is on the table, and we say 'there is one object on the table' we might well be counting by matter, which means that we should be interpreted as saying that *something is on the table and anything else on the table is the same matter as it* (compare Lewis 1999, 178).

One will have noticed a pattern in the theoretical work done by material identity according to disjointism: it does some of the theoretical work that is normally assigned to mereological relations on standard forms of pluralism. One further example of this is the critical question that we left unanswered at the end of the previous section. The electromagnetic force plays a central role in the scientific explanations of the macroscopic properties of objects encountered in daily life: such as what holds them together, how we are able to see them, and so on. Are we not automatically rejecting the explanations of features of macroscopic objects that are offered in terms of interactions between

⁷A further principle relating material identity and mass, which the disjointist must reformulate is *finite additivity*: if *x* and *y* are disjoint, then the combined masses of *x* and *y* = the mass of *x* + the mass of *y* (see Sanford Russell 2008, 255). This principle should be replaced by the following: if *x* and *y* are not partially the same matter, then the combined masses of *x* and *y* = the mass of *x* + the mass of *y*. Needless to say, more can and needs to be said about the wider consequences for measure theory but, as a general template, material identity would take over work done by mereological relations on the standard views.

⁸For example, another plausible principle: necessarily, *x* is the same matter as *y*, iff any fusion of *x* and *y* is the same matter as *x* and the same matter as *y*. If *x* is the same matter as *y*, fusing them doesn't generate new matter.

microphysical particles (and between them and electromagnetic forces), when these particles are not part of the relevant ordinary macroscopic object? That is to say, do adequate explanations of features of macroscopic objects in terms of interactions involving microphysical particles not require that these microphysical particles are part of the relevant macroscopic object?

One preliminary question here is whether parthood really plays any role in these scientific explanations. This is not obvious. If not, if properties of macroscopic objects are simply taken to be explained by physical facts about microphysical particles without presupposing anything about composition or parthood (relying perhaps only on co-location), then there is no obstacle to accepting these explanations as disjointist. If these explanations do however rely on the (possibly implicit) assumption that the microphysical particles are part of the macroscopic object, then the disjointist should here appeal to material identity instead. Properties of the macroscopic object are then naturally explained in terms of interactions of microphysical particles that are the same matter as it. In other words, a solid object at the macroscopic level is the same matter as a swarm of particles at a microscopic level and this may be (partially) involved in explaining certain features of that macroscopic object in terms of the interactions and physical behaviour of the swarm of particles.

Needless to say, we are just scratching the surface of an in-depth theoretic treatment of material identity. Saying more here would however be distracting, and also somewhat tedious when we see that material identity takes over a large fragment of the theoretical role of mereological relations on the standard view. For our purposes, it suffices to observe that this is a way of making sense of the materiality of objects and one that naturally fits with and supports disjointism. The dialectical point is that we can conceive of objects as being the same matter as each other without doing so on mereological grounds, or the sharing of anything, and that such a conception is theoretically tractable.

The resulting picture is as follows. The statue is taken to be the same matter as the lump. The statue is also the same matter as any plurality of objects that composes the lump, so, for example, the statue is the same matter as the bits of clay that compose the lump. The bits of clay do not compose the statue but they are the same matter as it. The statue and the lump can be co-located because they are the same matter, only distinct bits of matter cannot be co-located. Similarly, the mass of the statue and the mass of the lump do not add up because they are the same matter,

only a distinct bit of matter makes for additional mass.⁹ There is no good ground to object that the disjointist is at a loss to accommodate the non-additivity and co-location of things like the statue and the lump simply because it cannot do so on the basis of mereological relations.

4. The resort to material identity: objectionable on abductive grounds?

From here on, 'disjointism' refers to a view that accepts the material identity account of non-additivity and co-location. One might object that disjointism, so understood, is clearly unattractive if we compare it to the standard account of the non-additivity of co-located objects. Disjointism needs the added ideology of material identity together with basic metaphysical principles that govern it. That's more theory. The standard account, one might think, appeals only to mereological facts that we anyway need to accept and, hence, seems much simpler. If disjointism comes with additional brute facts and theoretical complexity, it remains unattractive when compared to the alternatives. I will argue that an objection on the basis of theoretical virtues gives no obvious good reasons to set aside (or continue to neglect) disjointism.

Any abductive comparison of theories is only sensible when we look at *total* theories or, at least, as comprehensive a view as possible. When we look at the more comprehensive theories of co-located objects, there are no obvious abductive grounds to reject disjointism.

First of all, we should not forget that the non-additivity and co-location of material objects isn't the only thing that a pluralist needs to make sense of. As we noticed at the start, disjointism seems to avoid the so-called grounding problem. Other forms of pluralism might have an answer to the grounding problem but this might well involve further theoretical machinery, such as a hylomorphic framework involving multiple notions of parthood (Fine 1999, 2010), sort-relative notions of composition (Hawley 2006), a mereology applied to tropes (Paul 2006), a stuff ontology (Kleinschmidt 2007), or differences between co-located objects taken to be

⁹Some think there is also a burden to explain why co-located objects do not make for causal overdetermination (see Merricks 2001; Paul 2007). If the lump's being 100 pounds causes the scale's gauge to move and the statue's being 100 pounds also causes the scale's gauge to move, doesn't this generate a worrisome causal overdetermination? One answer here is a form of compatibilism: the overdetermination is not problematic because the one object is the same matter as the other and the effects are nothing but effects of the relevant matter. We might go so far as to say that there aren't two *substantively* distinct causal determinations acting on the scale: the one's pushing on the scale *just is* the other's pushing on the scale because the one object is the same matter as the other (for this notion of generalized identity, see Rayo 2013, Ch. 1; Correia 2016, 2017; Correia and Skiles 2019).

brute facts (for discussion, see Rea 1997; Lowe 1998, 223; Bennett 2004; Koslicki 2004). I think that many of these accounts are *prima facie* tenable and interesting, but they might well (and I think the mentioned approaches indeed do) come with their own theoretical complexity or theoretical costs. A legitimate abductive comparison would compare the more comprehensive pictures of everything that needs to be accounted for. How the more comprehensive theories compare is therefore not a straightforward matter *even if* we were to accept that the resort to brute facts about material identity is a straightforward theoretical cost and that the standard account of non-additivity and co-location is entirely problem-free and costless.

Secondly, it's not the case that disjointism, understood as including a theory of material identity, shares all the basic commitments of the standard conception and simply adds further basic commitments about material identity. Again, matters are more complicated. For example, the standard account takes as a basic given that the weight of parts fails to add up to the wholes that they are part of and that parts can be co-located with their wholes. The alternative account does not take this as a basic (primitive) commitment but offers an account of this too in terms of material identity. Why can a part be co-located with the things that it's part of, and why does its weight not add to that of the whole? Because any part is partially the same matter as any whole that it is part of. *All* the explanations terminate uniformly in facts about material identity, including explanations of facts that are taken as basic commitments on the standard mereological account. The material identity account doesn't simply take the basic commitments of the standard account, adding further basic theoretical commitments to them. The material identity account relies on a different set of basic commitments and offers accounts of facts that are taken as basic by the more standard mereological account.

Thirdly – and I want to go into a little more detail here – (almost all) alternative forms of pluralism reject the extensionality principles. To me, this already speaks against these views. The parthood structures exemplified within the restricted domain of ordinary material objects are plausibly taken to be extensional. I will not emphasize this further. Instead, I want to briefly note how the rejection of extensionality principles has theoretical consequences that ramify. Consider three salient alternative views of ordinary co-located objects such as the statue and the clay:

The shared micro-decomposition view: there is some single plurality that composes both the statue and the lump, but the lump is not part of the statue, nor is the statue part of the lump.¹⁰

The solitary parts view: there is some single plurality that composes both the statue and the lump, and the lump is part of the statue but not vice versa.¹¹

The mutual parts view: there is some single plurality that composes both the statue and the lump, and the lump and the statue are part of each other.¹²

These views all accept that there is some single plurality, such as perhaps a plurality of micro-physical particles, that composes distinct co-located objects. They all reject the *uniqueness* of composition. In order to have a coherent mereology, rejecting the *uniqueness* of composition is not enough however, one's mereology cannot include any conjunction of axioms from which *uniqueness* can be derived. One must reject the uniqueness of composition *and* any combination of mereological principles that implies it. One such combination of principles is the conjunction of *antisymmetry* (two distinct things cannot be part of each other) and the principle that we can call *fusion inclusion*:

Fusion inclusion: If the *xx* compose *y*, then if all the *xx* are part of some *z*, *y* is part of *z* as well.¹³

Together with the *antisymmetry* of parthood, *fusion inclusion* suffices for the *uniqueness* of composition. One of them must be rejected to avoid *uniqueness*.¹⁴ But both are, arguably, rather plausible. The mutual parts view rejects *antisymmetry* and allows that two distinct objects to be *proper* parts of one another (on the standard 'non-identity' definition of 'proper part'). But it's tempting to think of a proper part as somehow included in the whole that it's part of (cf. Fine 2010, 560) and it's hard

¹⁰Baker (2000, 81), Burke (1992), Simons (1987, §3.2.4, §5 and §6), Zimmerman (2002). Note that the standard account, as I understood it above, relies on the basic principle that the masses of objects do not add up whenever one of them is part of the other. According to the shared micro-decomposition view, neither is the statue part of the lump, nor vice versa, and so it cannot offer this account at all. There is however another principle that it can appeal to, namely that the masses of objects do not add up whenever there is some plurality that composes them both.

¹¹Doepke (1982), Haslanger (1994), Rea (1998), Koslicki (2008).

¹²Thomson (1983, 1998), Cotnoir (2010, 2013, §3).

¹³This principle is included in the right-hand side of the algebraic definition of composition: the *xx* compose *y* =_{df} each of the *xx* is part of *y* and, if all the *xx* are part of some *z*, *y* is part of *z* as well (Lewis 1991, 1). On this definition of composition, *fusion inclusion* is simply true by definition.

¹⁴The proof is straightforward. Let composition be defined as follows: the *xx* compose *y* =_{df} each of the *xx* is part of *y* and no part of *y* is disjoint from each of the *xx*. that some plurality of *xx* compose both *y* and *z*. By this definition of composition, the *xx* are all part of *z*. By *fusion inclusion*, *y* is part of *z*. Similarly: the *xx* are all part of *y*. So, by *fusion inclusion*, *z* is part of *y*. This means that *y* and *z* are part of each other. By *antisymmetry*, *y* = *z*. Hence, composition is unique.

to make sense of *ordinary* material things being included in one another.¹⁵

On the other hand, *fusion inclusion* captures the thought that if some things are included in an object, then so are all the things that they compose. For example, if some bricks compose a wall, and those bricks are all part of a house, then the wall must be part of the house as well. Reject this principle and this opens up a proliferation of metaphysical possibilities, such as a distinction between the possibility w_1 in which both the bricks and the composed wall are part of the house and the possibility w_2 in which the bricks are part of the house but the wall that they compose isn't part of it. Of course, one could rule out such possibilities pertaining to bricks, walls and houses but that, yet again, would require further basic metaphysical commitments of its own (indeed, what would really be needed is a set of tailor-made principles forcing the inclusion of composed walls in houses yet not forcing the lump to be included in the statue).

None of these considerations are (in my opinion) conclusive reasons to reject any of these views, but, in the context of objections to disjointism on abductive grounds, it shows that the rejection of uniqueness is not free of revisionary consequences.

There are other conjunctions of principles that imply some form of extensionality. For example, another important mereological fact is that the combination of (1) *transitivity* (if x is part of y and y is part of z , then x is part of z), (2) *weak supplementation* (if x is a proper part of y , then some z is part of y but disjoint from x) and (3) *unrestricted composition* (for any plurality there is an object that they compose) suffice for the *uniqueness* of composition (Pietruszczak 2000/2018/2000/2018, 135–6). In fact, assuming the appropriate definitions, these three principles suffice for the entirety of classical mereology and provide a neat axiomatization of it (Hovda 2009; Cotnoir and Varzi, forthcoming, §4.3.2). Assuming that transitivity is non-negotiable, either *weak supplementation* or *unrestricted composition* needs to be rejected to avoid *uniqueness*. But, again, these principles seem independently plausible or otherwise theoretically desirable. For example, *weak supplementation*, which must be rejected by the *solitary parts view*, is taken by some to be absolutely central to our conceptual grip on the notion of parthood (Simons 1987, 116; Varzi 2008, 110; for discussion, see Cotnoir, 2021).

¹⁵Thanks to Aaron Cotnoir for the intuitive connection between proper parts and the notion of inclusion.

Not only are the extensionality principles independently plausible principles that relate mereological facts and the identity of material objects, rejecting them can have implausible domino-effects on how mereological facts relate to quantitative facts. To illustrate, here is another *prima facie* plausible fact about mass and arguably a central constraint on how we think of ‘proper parts’:

Proper parts, less mass: Necessarily, if x is a proper part of y , then (x ’s mass m < y ’s mass n)¹⁶

Proper parts of ordinary material objects are always ‘less matter’ than what they are part of because they are included in ‘larger’ wholes. This simple fact goes haywire on some alternative pluralist views. Consider for example the *solitary parts view*, according to which the lump of clay is a proper part of the statue but not vice versa. If we now assume that proper parts are strictly less mass than what they are part of, then the lump of clay would have to be less heavy than the statue, but it clearly isn’t. So, we cannot accept that proper parts are less matter than the wholes that they are included in.

Similarly, on the *mutual parts view*, the statue and the lump are proper parts of each other (on the standard definition of proper parts).¹⁷ If we assume that proper parts are always less than what they are part of, the lump and the statue are less mass than each other, which seems incoherent. Again, we are unable to accommodate the simple idea that proper parts have less mass than what they’re part of.

Revisionary consequences for our understanding of parthood risk turning into revisionary consequences for plausible facts that relate mereological structure and mass. It’s therefore unclear whether the standard account can in general be said to offer an entirely unproblematic view of the quantitative aspects of objects. Once more, that’s no knockdown argument against these views but it bears on any abductive comparison of theoretical virtues. It also highlights how central the extensionality principles are to our conception of material objects and highlights the interest of any pluralist view that allows us to maintain them.

¹⁶The principle is only intended to apply to ordinary material objects with non-zero mass.

¹⁷The mutual parts view can adopt a non-standard definition of proper parts (Cotnoir 2010, 2021), on which the lump and the statue are not proper parts of each other. But the literal notion of ‘proper parts’ may not really be so central to the thought behind *proper parts, less mass*. We can circumvent talk of ‘proper parthood’ altogether. Consider the following alternative formulation of the *proper parts, less mass* principle: if x is part of y , then either x is identical to y and the same mass as y , or x is not identical to y and less mass than y .

Disjointism demands further attention. Yes, it offers a non-standard conception of the tiny parts of some objects but not one that is incoherent or obviously untenable. Yes, disjointism may require additional theory to account for the non-additivity of co-located objects and their ability to co-locate but, so supplemented, it's not at a loss to accommodate what needs to be accommodated. Given its distinctive take on the grounding problem and its acceptance of the extensionality principles, any quick rejection on abductive grounds is misguided.

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