Working parts: reply to Mellor

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Whenever a material thing has parts, those parts are located where that thing is.[1] This is a necessary truth, and needs explaining.[2]

Two kinds of explanation might be put forward. The first goes like this: the necessary connection between the location of a whole and the location of its parts holds because the location of the whole is *nothing but* the collective location of its parts. The second style of explanation goes like this: the connection holds because *what it is* for a material whole to have something as a part, is (perhaps among other things) for the whole to contain the part.[3]

The first line is a 'partist' view.[4] It takes the mereological part-whole relation as prior in the order of metaphysical explanation to the location of material wholes. The second is 'locationist'. It takes the location of compounds to be prior in the order of metaphysical explanation to the mereological relations in which they stand.[5]

I read Hugh Mellor, in his stimulating paper "Microcomposition", as a locationist. I aim to give a qualified defence of the version of locationism (the "working part" view) that he there outlines.

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[1] Assumptions: if one believes that the parthood relation is relativized to times, then read this principle as concerning the parts of an object at a time. Throughout this paper, I shall ignore the alleged possibility of material objects being *multiply located* at a single time.

[2] It is closely related to what Sider (2007b) calls the 'inheritance of location'. Compare also the principle called 'parts to subregions' in Saucedo (forthcoming). There are other inheritance principles linked to parthood: the putative necessity that the fusion of two simple 1g particles weighs 2g; the putative necessary inheritance of intrinsicness: if something is intrinsically red, then any fusion of that thing has red as a part. These raise issues I will not discuss here.

[3] Compare van Inwagen's 'general composition question' (van Inwagen, 1990, ch 4.).

[4] This is not the sense of 'partism' employed by Hudson (2001).

[5] So presented, this presupposes that there is unitary notion of location and parthood, in application to compound material things, such that we can formulate the general question of whether one reduces to the other. But in principle, one might postulate a plurality of such relations.

Pluralism about the parthood relation becomes, I think, more attractive if we are pluralist about *non-fundamental* parthood relations: giving different and perhaps kind-specific analyses of parthood in terms of a single primitive notion of location (and perhaps a single fundamental parthood relation obtaining between space-time regions). See Hawley (2006).

The paper is divided into nine sections. In 1-3, I outline the background, and look at varieties of partism and locationism, as well as rival approaches, prominent among them the 'no analysis' view. In sections 4 and 5, I discuss reasons for dissatisfaction with the no analysis and partist views. In section 6, I look at the simplest form of locationism: one that simply identifies parthood with the relation of containment. In section 7, I critically examine Mellor's more sophisticated version of locationism, which requires, in addition to the containment condition, that any material part of a thing be what he calls a 'working part'. In section 8, I give more theoretical grounds for favouring something like the working parts condition over the pure containment proposal. Finally, in section 9, I briefly contrast the locationist project that emerges with a best representative of the view that material wholes are 'nothing but' their parts.

1 Fundamental properties vs. the rest

The phrases 'nothing but' and 'what it is to be' in the characterization of partism and locationism are vague. To the extent that this gives neutrality between various ways of thinking about these pivotal metaphysical notions, that is an advantage. But their crucial role should be noted: without appeal to such notions—or the related 'constitutes' 'analyzes' 'prior in the order of metaphysical explanation'—it would be hard to say what the difference between the locationist and partist. After all, nothing we've seen as yet has given us reason to think these theorists need to disagree about what is part of what, and what is located where.

It will be useful to have a particular model of metaphysical explanation to focus discussion, so I spend a while describing one. Lewis (1983) argued that there is an objective distinction between a range of 'elite' properties (perhaps including fundamental physical properties such as mass and charge) and merely 'abundant' properties. Abundant properties come cheap: almost every meaningful predicate can be taken to stand for one: so *being grue*, for example, is a perfectly good, though merely abundant, property. But elite properties are rare: on one conception, *only* the most fundamental properties of a completed microphysics will have this status.[6] The metaphysics of these elite properties is a topic in itself. Lewis (1983) himself describes several

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[6]Mellor (1991)—using slightly different terminology—argues for a similar division. In his terminology, all properties and relations are elite properties and relations (and figure in laws of nature). What we have been calling 'abundant properties and relations' he would call *concepts*. See Mellor (1991).

versions, ranging from a realist ontology of Universals, to a position taking eliteness itself as a primitive distinction between properties.[7] However it is cashed out, the elite/abundant distinction proves invaluable. Lewis, for example, appeals to it in giving accounts of laws of nature, of counterfactuals, of dispositions, of causation, of intrinsicality and duplication, of mental and linguistic content, and of physicalism itself.

What can we say about the elite properties themselves? In common metaphors, the elite properties are supposed to describe 'the furniture of the world in the most fundamental terms' and to 'carve nature at its joints'. Minimally, the pattern of instantiation of the elite properties at a world should serve as a supervenience base for the total qualitative state of that world.[8]

For the purposes of this essay, I will draw no distinction between any of the following: 'elite properties', 'genuine properties', 'metaphysically primitive properties', 'fundamental properties', 'natural properties', 'perfectly natural properties'.[9] The terminology should also be understood to leave open which properties turn out to be elite: there is no initial assumption that they are *physical* properties, nor that they figure in empirical science in an interesting way. All that is left open for further discussion. Theorists agreed about the framework may at this point diverge: Lewis held the substantive view that the elite properties instantiated at the actual world are microphysical properties, and the only elite relations are spatio-temporal. Mellor (1991) holds that the elite properties play a distinctive role in natural laws: if there are genuine non-microphysical laws, there are non-microphysical elite properties.[10]

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[7]See Sider (2007c) and Sider (2007a) for interesting discussion of ways to make this option compatible with nominalism about properties in general. He also argues for extending the elite/abundant distinction to entities of any category: the worldly correlates of names, operators, modifiers and the like, as well as predicates. See Hirsch (1993) for further discussion for the object and property cases.

[8]Of course, such supervenience claims demand careful formulation, which I won't go into here.

[9]One might wish to draw finer distinctions using such terminology. For example, in Dorr (2004), a distinction is drawn between *metaphysical primitive* properties and relations and the rest. In Dorr's hands, the primitives are not those properties that Lewis would call perfectly natural, i.e. those that correspond to a Universal. Dorr regards the Realist as postulating a the primitive relation of *instantiation*. In addition, they postulate various elite Entities: Mass, Charge, and so on. The property *having mass* is not itself primitive: it would be one step away, being expressible in fundamental terms by the impure relational predicate *instantiating Mass*. So Lewis's perfectly natural properties are in this picture definable on the basis of more basic distinctions.

[10]Compare Schaffer (2004). Lewis himself at times suggested that, instead of the all-or-nothing division into elite vs. abundant properties, one might help oneself to a primitive grading of properties into the more or less elite (perhaps with there being no maximal grade on this scale). I won't speculate about how this would fit with his theories. Some, at least, would require alteration. Likewise, some others think that elite properties are themselves ordered by metaphysical priority. I don't have enough of a grip on either notion to go into this in further detail.

2 Locationism and Partism

Both locationists and partists, we shall assume, take location as an elite relation.[11] The latter, however, make do with primitive location relating only *mereologically simple* material things to space-time regions. When we turn to ordinary thought and talk, 'is located at' will express a merely abundant relation. It will be true, of course, that I am located at the region I occupy; but this will be made-true, by instances of the *elite* location relation involving my simplest parts.

The situation is reversed when it comes to mereological relations. Both can believe in a primitive parthood relation.[12] But the partist believes that this elite relation holds between material things and their parts, whereas the locationist (assuming they believe in it at all) think it holds only between non-material things: perhaps space-time regions, perhaps between states of affairs and their constituents. Just as the partist owes a story of what makes-true location-talk in application to macro material things, the locationist owes a story about what makes-true talk of material things being parts of one another. We shall consider some variants of each position in turn.

The locationist thinks that material things are primitively located, but not primitively part-whole related. They are not error-theorists about mereological talk: the leg is part of the table.[13] But what is it about the leg and the table that makes this the case? The obvious resource, for the locationist, is the relationship of *being contained within*, where *a* is contained in *b* iff *a*'s location is a subregion of *b*'s location.[14] An extreme version of locationism will say that containment is a sufficient, as well as necessary, condition for parthood. More moderate versions will deny this.[15]

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[11]This is a substantial assumption. It incorporates a commitment to *substantivalism*. I shall also assume that *subregionhood* is an elite relation between space-time regions. Other primitives are presumably needed (cf. the betweeness and congruence relations described in Field (1984).) Relationists regard locations at best as logical constructions, and prefer to posit elite spatio-temporal relations between material thing. What elite notions they need is an interesting question: cf. Field (1984).

[12]Again, other choices of mereological primitive are possible. See Simons (1987).

[13]Compare Field (1984, p.34):

> From a substantival viewpoint, it is natural to regard this notion [parthood] as one that applies fundamentally to space-time regions (though of course it applies derivatively to the objects or other aggregates of matter that occupy those regions).

[14]Throughout, I will use 'location' for what Parsons (2007) calls 'exact location'. Despite the name, I don't presuppose that exact locations have to be precise.

[15]As Jacek Brzozowski pointed out to me, it's not at all clear to what extent the locationists abundant parthood relation will satisfy the axioms of standard axioms of mereology (Simons (cf. 1987)). For example, it seems to

A radical locationist view (not Mellor's) is that of the *supersubstantivalism*. This theorist says that *location* is simply identity: material objects just are space-time regions. That is not to say that every space-time region counts as a material object, nor that every instance of subregionhood between space-time regions should count as a case of material parthood.[16] So even the supersubstantivalist need not be an extreme locationist.[17]

Mellor's locationist view, to be discussed more extensively below, doesn't take the extreme form. Rather, parthood is constituted by containment *together with something else*: Mellor aims to cash out the 'something else' in causal terms. So the view is that things only get to be parts of a whole in which they are contained if they are, in Mellor's phrase, *working* parts of that whole.

Partist views likewise come in various flavours. The basic idea is to take the location of some things as primitive: say, the locations of subatomic particles.[18] Fusions of such entities are located, but not *primitively* located. Again, we can hope for illumination about the conditions under which it is true to say that a compound object is located at a given region. The most obvious way to do this is simply to say that what it is for a mereologically complex thing x to be located at a region R is for R to be the sum of the regions at which x's simple parts are located.

However this is an extreme view of the matter. Suppose that my simple parts are all point-particles. If my body is the sum of such point particles, then my body will occupy a scattered region which simply consists of finitely many points at which the particles are located. Such a view doesn't sit well with the folk understanding of the location of things like me. It seems

be left open by the above characterization that an object might have a single proper part (if one object is located in a subregion of the other, and no other object is located thereabouts); but is in conflict with supplementation principles. As discussed below, even the transitivity of parthood is endangered once we start imposing extra constraints on the the a-parthood relation beyond containment.

Of course, the mere *possibility* of such violations doesn't show that such principles are *actually* violated. And I think that the idea that such principles are necessarily satisfied loses some of its attraction when—with the locationist—we don't conceive of parthood as a way in which reality is fundamentally structured, but merely as a way of communicating information about the locations of objects (and perhaps other independently interesting relations in which they stand).

[16]If not all space-time regions are material things, then this might be a mere matter of linguistic convention over what to apply the term 'material object' to; or one might hold there is an objectively distinguished class of space-time regions which are the material objects, i.e. to think that *being a material thing* is itself an elite property.

[17]There might be some question about whether the supersubstantivalist quite fits the characterization of locationism. But so long as identity counts (at least for present purposes) as an elite or primitive relation, and so long as there are instances of subregionhood which are not instances of material parthood (whether due to some regions not being material things; or some subregion relations between material things not being part-whole relations) then the supersubstantivalist will satisfy the characterization.

[18]Quantum physics renders problematic the notion of particles having determinate location. However (a) nothing in what follows relies on *determinacy* of location; and (b) if one did think that the partist view requires determinacy, it is well to recall the Bohmian version of quantum mechanics, whereby each particle has determinate location.

nnatural to take me to occupy a larger space than that: for my body to occupy a region with some positive volume, for example.

Extremists can defend their position by distinguishing being *located* at a region from *dominating* that region.[19] Something dominates a region, roughly, if it causally excludes a wide-enough range of objects from occupying that region. So my body dominates a region of finite volume 'where I am' in virtue of causally excluding pens, thimbles, cricket balls and the like from being located there. Extremists may suggest that—at least in the case of macro-objects—folk thought about location tracks domination rather than location proper, thus 'explaining away' apparent oddities in their view of locations.[20]

Since we're not taking location of compound things as fundamental, one might think that the extremists' 'strict location' is a needless detour. Why not simply say that the *location* of a macroscopic object is the region that it dominates? We'll have to be sure that the relevant sense of 'domination' of a region can be spelled out without appeal to the location of the whole, and it may be to some extent vague and context sensitive. But its not implausible that this could be done, nor in this setting does its vagueness or context sensitivity seem worrying.

3   Rival views

Up to this point, we have been talking as if we were faced with a choice between analyzing mereological notions in terms of location, or vice versa. But these options aren't exhaustive.

The most obvious rival view would have it that *neither* the material part-whole relation *nor* the location of composites should be analyzed (even in part) in terms of the other. In the terminology introduced earlier, perhaps both location and parthood are elite relations; and further, fundamental parthood relates the chair to its legs (contra the locationist view), and fundamental location relates the chair to a—perhaps gappy—chair-shaped region of space-time (contra the partist view). Call this the 'no analysis' position.[21] This last view deserves serious

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[19]See Hudson (2005, p.5) for the distinction.

[20]It's not so clear that domination is a good description of folk thinking about location in the case of micro-objects; but equally it's not so clear that the we should require the folk to have stable intuitions about objects so removed from everyday experience.

[21]Another possibility would be that there is some substantive analysis of the location of mereologically compound things, but that it need not mention parthood at all; or some substantive analysis of parthood, that never mentions the locations of the mereologically compound entities. I would take such positions seriously, if I could

consideration. I'll examine an argument against it shortly.

There are two interesting positions that I'll mention in passing where relevant, but won't focus on. Both threaten a somewhat radical metaphysics, but (partially in virtue of this) deal very nicely with the puzzles to be presented.

The first radical view that evades the puzzles here formulated is that of the microphysical mereological nihilist: who not only refuses to include location as a elite relation (with which the locationist can agree) but also maintains that no material thing exists except for the smallest particles of fundamental physics.[22]

The second radical view is that of the mereological *logicist*: someone who thinks of parthood as a logical relation. One version of this view says that composition is identity: If the fusion of some things is *a*, then those things are collectively identical to *a*. The view has radical implications. On the side of logic, identity becomes a many-many relation and the logic of plurals must be revised.[23] On the side of metaphysics, it is arguable that mereological essentialism (each thing has its parts essentially) and the even weirder principle of mereological sufficiency (things have their fusion essentially) follows.[24]

For the time being, I shall assume that both mereological logicism and mereological nihilism fail.

4 Explaining necessities

There are three positions to be considered: the mereology first view whereby location of a whole reduces to (among other things, perhaps) the locations of its simple parts; the location first view, whereby parthood reduces to (among other things, perhaps) containment relations among the locations of the relata; and the no analysis view, whereby neither parthood and location features

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see any plausible candidates.

[22]See Dorr (2002), Dorr and Rosen (2002), and Williams (2006).

[23]See Sider (2007b). Sider rejects strong composition as identity on the basis of its impact on plurals. He endorses what he describes as a modest version of composition as identity. I'm not sure whether that should still be thought as a version of logicism about mereology.

[24]If one accepts the necessity of identity, and the view that composition is identity, then if *xx* compose *y*, it would appear that they do so necessarily. There is some wriggle room here, however, particularly if one is prepared to endorse a counterpart theoretic treatment of modality *de re*. Thanks here to Kris McDaniel and Ross Cameron for discussion.

in an analysis of the other.[25]

The case starts at the observation with which we began this paper. The following is a necessary truth:

if a thing x has a part y, then y is located in a subregion of the location of x.[26]

If the no analysis view were correct, this necessary truth would appear to be *brute*, in the following sense: it concerns the connection between two fundamental properties (location and parthood). It is not an instance of a logical truth, given that we've discarded mereological logicism for the moment. But it is a necessary truth.

Contrast the rival positions. If the locationist view is accepted, then the proposition is not yet fully analyzed: it is not yet expressed in 'fully elite' terms. In fully elite terms, reference to pats will disappear in favour of reference to relations among the locations of things (and perhaps extra conditions C). What we end up with is something tautologous:

if a thing x is located in a superregion of y's location, and $C(x, y)$, then y is located in a subregion of the location of x

In short, the locationist can reduce the datum with which we started—the necessity of the location-parts connection—-to the necessity of a tautology. The partist can do something similar, replacing unanalyzed appeal to the location of a composite object with reference to the locations of the parts of that thing, again reaching something tautologous:

if a thing x has a part y's, then the sum of the locations of x's parts contains y's location as a part.

Either of these, I claim, would be an explanatory advance. It is not that the necessity of tautologies is itself explanatory bedrock. But presupposing that a theory of modality by itself to explain *at least* the necessity of logical truths is an extremely minimal assumption, and makes

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[25]In the following, I indebted especially to Dorr (2004), Saucedo (forthcoming) and Brzozwski (forthcoming).

[26]Here 'part' can be construed to include improper parthood (where $x = y$), and 'subregion' should be construed include improper subregionhood. (Thanks for Jacek Brzozwski for pointing out that without this generous reading, the principle is in danger of counterexamples).

it legitimate for us to 'pass the buck' of explaining such necessities to that theory.[27] Of course, it *may* be that the one true theory of modality will explain, all by itself, why the parts-location principle is necessary.[28] But one cannot *assume* that the theory of modality will provide such resources. So one cannot pass the explanatory buck–if we are to claim that a theory of modality can explain our datum, we have to indicate how this can be. The unsupplemented no analysis view, by contrast with its rivals, leaves us with modal mystery *at the most basic level*.

A defender of the no analysis view might respond in a number of ways. A first option is to make a case that everyone is committed to relevantly similar 'mysteries', so that no new explanatory debt is incurred.[29] A second is to take up the burden of developing a theory of modality that is designed to explain how the location-parts link can be necessary.[30] A final option is to accept the modal mystery as a cost, but claim it to be outweighed by compensating benefits.

The first option might seem the most immediately attractive. After all, post-Kripke orthodoxy warns us against thinking of logical or a priori truths and necessary truths as marching in step. Let us look closer at the Kripkean (putative) necessities. One class includes such putative necessary truths as: "Socrates is human", "this table is made of wood" and "Philip is Charles' father": the necessity of kind-membership, of constitution, and of origin. And perhaps we can find examples of this kind involving elite vocabulary: "Sparky is an electron", say.

Even if we accept these as necessary truths, there is a tradition of looking for illuminating explanations of the source of such *de re* necessities. In a deflationary spirit, Lewisian counterpart theory offers a semantic explanation of how such *de re* necessities emerge.[31] The putative *de re* necessity that Socrates was necessarily human might first be reduced to the claim that all

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[27]We should be prepared to be a little flexible in fixing what logic provides our initial stock of tautologies. For example, it seems plausible to me that the distinctions to be made will rely on using a two-sorted logic (with some variables ranging over space-time regions, and other variables ranging over material things). That will prevent, for example, us worrying too much about possibilities of material things being subregions of one another (though otherwise bearing the same relations to one another).

Of course, every new necessary truth that we pack into the logic is in one sense a hostage to fortune: for we will ultimately have to explain why the *logic* is necessary, and that task will get harder the more we pack into 'logic'.

[28]For one likely candidate, see Sider (2003).

[29]Dorr (2004) argues that positing any asymmetric primitive relations will lead to brute necessities. One might see this as a strike against fundamental asymmetrical properties, as Dorr does: or, finding it overwhelmingly natural to posit such things, one might view it as lessening the impact of pointing to brute necessities.

[30]One option here is to argue that necessities don't *demand* explanation—perhaps because the distinction between possibility and impossibility is not the sort of natural division that requires further explanation. See (Cameron, 2008) for discussion of related issues.

[31]Cf. Lewis (1968).

(possible) counterparts of Socrates are human. Secondly, for something to be a counterpart of a thing it must be similar *in the contextually relevant sense* to that thing. Third, the contextually relevant sense of similarity in this instance requires that the two things share the same kind. In the end, therefore, the *de re* necessity reduces to something that follows tautologously from Socrates being human: that all possible things that are similar (minimally in that they are of the same kind as Socrates) are human.[32]

So the demand for explanation of non-logical necessities is not inconsistent with Kripkean necessities: it merely imposes a (fairly reasonable) constraint on that debate. Notice that the non-logical necessity facing the no analysis view is *de dicto*, so the strategies for explaining away non-logical *de re* necessities are unlikely to help.

Some Kripkean necessities demand a different sort of explanation, however: paradigmatically, the putative necessary truth that Hesperus is Phosphorus, and that everything made of water is made of H2O.[33] But recall that our concern was with non-logical necessary truths *stated in fully analyzed, elite terms*. We may assume that vocabulary would not have two names for the single thing—Venus—nor would it have the predicate 'is water' where (ex hypothesi) this can be analyzed in a complex predicate involving Hydrogen, Oxygen, and bonding relations.

So, absent further explanation, it looks like nothing in the Kripkean canon prepares us for the sort of brute necessity to which the no analysis view is committed. And, indeed, the felt need for explanation in the Kripkean cases (and the prospects of doing so) strengthen the case that an explanation of the location-mereology link is required.

The case to this point has involved no great theoretical commitment, simply appealing to certain explanatory burdens. I will briefly consider a more theoretically loaded way of arguing that the no analysis view is committed (absurdly!) to denying the necessity of the inheritance of

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[32]Note that the latter two steps are crucial. If one took only the first step, for example, and postulated counterparthood itself as a perfectly natural cross-world relation, then one would be left with a prima facie modal mystery about the connection between counterparthood and sameness-of-kind.

It has been suggested to me that one might try to explain the parts-location necessity, and other non-analytic de dicto necessities, by endorsing something like a counterpart theory concerning properties as well as individuals. Setting aside the technical questions about how this might work (and they're non-trivial) the point just made becomes pertinent. Counterpart theory alone won't discharge the explanatory burden: one would need something analogous to the Lewisian analysis of counterparthood in terms of similarity. And its obscure to me what could play that role in the property case.

Thanks to Raul Saucedo for discussion here.

[33]One might try to reduce the latter to the former, by arguing that it holds in virtue of the necessary truth that the kind *being Water* is identical to the kind *being H2O*

location. This is explored in recent work by Raul Saucedo (forthcoming) and Jacek Brzozowski (forthcoming). The idea is to appeal to (something like) *recombination* principles, which say, roughly, that for any possible pattern of instantiation of a primitive property *P* and any possible pattern of instantiation of a distinct primitive property *Q*, the two patterns of instantiation are compossible. It is an articulation of the idea that the elite properties should be *independent* of one another.[34] If the case against no analysis can be reinforced by appeal to principles that play a central role in the metaphysics or epistemology of modality, that would of course be a welcome result for me. But the case from unexplained necessities against no analysis does not rest on it.[35]

5 Generalizing the argument

It is natural to think that the argument from modal mystery against the no analysis view will generalize to afflict the partist and locationist views.

The partist distinguishes between elite location (e-location), enjoyed by simples alone, and abundant location (a-location) which all material things possess. But is it *necessary* that only simples are e-located? If so, then the following looks to be a brute necessity:[36]

> If *x* is e-located at some region, then *x* has no proper parts

On the other hand, if compound things can be e-located, then we should ask whether the e-locations of a things parts constrain its e-location. In particular, is the following necessary?

> If *x* is part of *y*, and both are e-located at regions, the e-location of *y* is a superregion of the e-location of *x*

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[34]Often some further condition is imposed: for example, the condition that the relevant elite properties be 'wholly distinct'. This allows us to wriggle out of the otherwise worrying point that determinants of a determinable often seem to be incompatible. See Armstrong (1978) for some further articulation of this idea, and Sider (2005) for critical discussion.

[35]For formulations of recombination, and related ideas, that might do the work here, see in particular Dorr (2004) and Saucedo (forthcoming). Such principles place *extremely* strong constraints on what metaphysical primitives we should endorse (consider their impact, for example, on our choice of *geometrical* primitives such as betweeness and congruence). That makes them an interesting methodological starting point, but lessens the costs of admitting counterexamples.

[36]Compare Brzozowski (forthcoming, fn. 33).

On the one hand, if it is necessary, this would again count as a brute. But on the other, a possible violation of this principle is hardly any more plausible than a possible violation of the datum connecting a-locations with which we started. Any way she goes, the partist looks in trouble.[37]

What of the locationist? For her, parthood in application to material things is a merely abundant relation: a-parthood, in contrast to the e-parthood in which the partist believes. But digging deeper, it's not so clear that the locationist is in a position to *deny* e-parthood. For as I have presented it, the locationist's ontology includes *space-time regions* structured by a *subregion* relation.[38] Many think of subregionhood as (i) an elite relation; and (ii) as mereological: e-parthood among space-time regions. So it looks like we can fairly describe the locationist as believing in both e-parthood and a-parthood: maintaining that the former never holds among material things.

A dialectic parallel to that above arises. Is it possible for material things to stand in the primitive part-whole relation? If not, then the following looks like a brute necessity:

If x is a material thing, then x has no e-parts.

But if material things can be e-part related, then we again get back to a seemingly necessary non-logical truth stated in elite terms:

If x is an e-part of y, the location of x is a subregion (e-part) of the location of x

Possible violations of this principle look just as wacky as possible violations of our initial datum.

The best response, in each case, I think, is to take the first horn of the dilemma: the partist should deny the possibility of compound things being e-located; and the locationist should deny

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[37]Other potential trouble comes from the observation that the partist seems to have to deny the possibility of material gunk: material things whose parts always themselves have parts. Since the a-location of compound material things was supposed to be fixed by the e-location of its *simple* parts, it appears that the claim that there is located material gunk would turn out, on analysis, to be contradictory.

See Williams (2006) for critical evaluation of arguments for the possibility of gunk, and Brzozowski (forthcoming) for related discussion.

[38]I'll continue to speak in terms of this structured substantivalist ontology of space-time so as not to introduce too many parameters. But the dialectical setting may well be sensitive to such assumptions. For example, if one could get away with an ontology of space-time points, a plurality of which could collectively constitute the location of a material thing, then one might be able to replace the ideology of subregionhood with the devices of plural logic. One would face the burden of demonstrating that space-time geometry could be adequately developed in such a setting. I won't explore this further here.

the possibility of material things being e-parts of one another. But why isn't this just postulating more modal mysteries?

I'm not sure that the worry can be fully avoided (if it can't, that strengthens the case for mereological nihilism and logicism). But I think the locationist has the better prospects of explaining the necessity to which they are committed.

Here is one way of presenting the idea. Imagine a two sorted logic, with one variable-sort α ranging over regions, another, a, ranging over material things. And suppose that the locationist's primitive location predicate is of the form "α is located at a", and the only primitive parthood predicate is of the form "α is part of β". Then it would simply be ill-formed to ask whether a is part of b, for material objects a and b. It will be a *logical* truth of this two-sorted logic, that nothing that is located can stand in the part-whole relation.

In the present case, this seems more than a formal trick. To begin with, the divide between regions and material things correspond to what one might call a difference in ontological category: it is not ad hoc to reflect this in logic, in the way it might be to use different sorts of variable to range over simple and compound things.[39] Moreover, there's some intuitive backing for the distinction. The impossibility of material things to be subregion-related simply doesn't seem to cry out for explanation in the way that the location-mereology link does (it is a nice question why this might be). Finally, arguably everyone is going to need to endorse category-restricted necessities based on exactly this divide: in particular, it seems to be impossible for material objects to stand in the *location* relation to each other, or for regions to stand in that relation to (distinct) regions. That those impossibilities follow from sorting the logic, lends it credibility.

So—tentatively—I suggest that the locationist, unlike the no analysis view and the partist, avoids modal mysteries.

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[39]This is one reason why the analogous move in defence of partism seems less plausible. It is anyway less obvious how the partist defence would go: presumably both simple and compound things can be parts of compound things, which suggests a primitive part-whole relation would have to have generic material object argument places. Given this it's not clear how the required necessities could fall out of the sorted logic.

6 Against extreme locationism

If the no-analysis and partist views generate modal mysteries, things are looking good for the locationist alternative. Attention then turns to the conditions under which one thing is part of another. An extreme proposal was that *containment* was a sufficient condition for parthood. This has the virtue of simplicity, at least: can it be defended?

The obvious strategy against the extreme approach would be to invoke intuitions about particular cases: to point to cases of containment which are not intuitively cases of parthood. In this section, I will stick with this tactic, and delay to section 8 discussion of alternative ways of arguing for a moderate locationism.

Mellor offers counterexamples to the view that the containment condition is sufficient for parthood: low energy photons might pass through material bodies, intuitively without becoming temporary parts of those bodies. And space-time regions might be taken to be contained in my body: but are not parts of my body.[40]

The latter worry can, I think, be evaded. I suggested earlier that we should read 'containment' as reducing to the subregion-relation holding between the locations of things. If that is right, then to generate the puzzle we'd need to take regions to stand in the primitive location relation to themselves. But I don't see any reason to grant that premise. We might allow 'loose talk' of regions being located at themselves (where else?): but that sort of talk needn't form part of our official metaphysics. Let us concentrate, therefore, on the case of transient particles.

Consider a particular material body—Window—and some particle—Photon—we have:

1. Photon is contained within Window

2. Photon is not a part of Window

From these two, it follows that containment (at a given time) does not suffice for parthood (at that time).

To deny the first we have to deny that Photon is part of Window. Recall the distinction between the region Window (properly speaking) *occupies* and the region it *dominates*.[41] What

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[40]Of course, the supersubstantivalist will hold that my body is simply a—particularly interesting—space-time region. But even they might wish to deny that some scattered space-time region wholly contained within my body is a material part of it.

[41]See the discussion of partist views earlier. Something dominates a region, if it causally excludes a wide-enough range of objects from occupying that region (shoes, string and sealing wax, etc). The notion of domination

is common ground is that Window dominates a continuous and approximately cuboid region, and that Photon is within that region. But if some objects dominate regions they don't actually fill, this doesn't close the case. Perhaps the location of the window will be a rather discontinuous and gappy region within the cuboid region defined by the windowframe. If so, the Photon might simply be 'passing through the gaps', just as the water in a wet sponge fills the gaps between parts of the sponge, without ever being collocated with it.

Mellor discusses parallel issues when considering what the boundaries of an aeroplane should be taken to be. He contrasts what he calls the full plane (which occupies a region including the interior of the plane, and so contains its passengers) and the empty plane (which doesn't). In the same spirit, one might contrast the full sponge (containing water) from the empty sponge (whose location is full of gaps which water occupies). And likewise, we might also distinguish between the continuous window—occupying the region we can all admit that the window dominates—and the gappy window, which occupies a scattered region corresponding to the location of each of its atoms. To make the case for premise (1), we need to be convinced that Window isn't a gappy window.

How the debate should proceed from this point will depend on how liberal a material ontology one believes in. Outside science fiction, a material object surely cannot occupy two distinct regions: so the putative full and empty planes cannot be the same thing. Therefore, if there is currently only one aeroplane on the runway, then at least one of the full aeroplane and the empty aeroplane fails to *be* an aeroplane. A liberal ontology might allow that nevertheless, objects meeting the description of the 'full plane' and 'empty plane' exist, and there remains just the question: which is really *an aeroplane*.[42] Likewise, perhaps material things corresponding to the 'continuous window' and the 'gappy window' both exist, and there remains just the question: which is the *window*.

A rival views posits only a single object in the vicinity of the window, and askss whether the location *of that object* was continuous or gappy.

Either way, work must be done to secure the first premise. Read in the illiberal way, we

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is going to be relative to a class of objects, and also requires elaboration on what the sense of exclusion is.

[42]This would turn the situation into a version of Unger's problem of the many, mentioned by Mellor. An epistemicist treatment of vagueness, to which Mellor is sympathetic, might say that it is a vague matter which of these candidate objects is the aeroplane, though there is a fact of the matter which one it is. Mellor himself does not favour this proposal, however.

need an argument against the existence of gappy window, and for the existence of a continuous window. Read in the liberal way, we need an argument that even though such gappy objects exist, they are not good candidates to be windows. There is plenty of room here for a convinced extremist to defend her position by denying that Photon is contained in Window.

But just because premise (1) *can* be consistently denied, doesn't mean it *should* be. There is considerable intuitive appeal to the view that Window is not a gappy object (whoever dreamt that windows might be zero-dimensional objects, occupying a mere sum of finitely many points!). Indeed, one might think that it is exactly an advantage of the location view that it is able to sustain ordinary intuitions about the locations of material objects, and not get sucked into the Eddington-style picture of the world of 'scientific objects', where the properties of the microphysical parts of the window are taken to be a definitive guide to the hidden nature of the macroworld. So let us allow premise (1), if only for the sake of argument.

Supposing Window to contain Photon, attention turns to (2). Denying this involves taking Photon to be a temporary part of Window, albeit not a very interesting one, since it doesn't have any very significant influence on the whole: in Mellor's nice phrase, it is not a 'working part'.

It should be granted, I think, that intuitively Photon is not a part of Window, as it sails through in nanoseconds. The best response, for the extremist who grants that the containment condition is met, is to *explain away* such intuitions pragmatically. And just as Mellor will appeal to the notion of a 'working part' *in formulating his analysis of parthood*, the extremist will presumably need to appeal to the notion of a working part *in formulating what is communicated by ordinary ascriptions of the part-whole relation*.[43] I'm not sure much of significance should hang for the locationist on whether they deploy the working part criterion within semantics or pragmatics, so I'll set this pragmatic defence of extremism aside.

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[43]Compare the following: at a graduation ceremony, I say that I have relatives in the crowd. Now, in one sense, all the people in the crowd are my relatives: we share a common ancestor at most a few thousand years removed. But of course, in context you understand me as saying that I have some close relatives—parents, siblings, cousins—present. Now, there is a question concerning which of the following holds:

- The relation expressed by 'is a relative', used in context, literally relates me to each person in the room. There is a (say) Gricean explanation of how, by using that expression, I communicate something about the presence of close relatives.
- The relation expressed by 'is a relative', used in context, literally relates me only to close relatives.

7   Moderate locationism: the working parts view

Mellor sets out the working parts condition thus:

> [The working parts condition must] must admit that things *inside A* can have effects
> on *A*'s properties that are too slight to make them parts of *A*. It can only require a
> thing's parts to have effects that are both significantly large and on properties we
> take to be important to things of that kind. (Mellor, section 5).

The idea, then, is that the analysis of parthood is something like the following:

> *A* is a proper part of *B* iff (a) *A* is contained within *B*; and (b) *A*'s having the
> properties it has some significant causal effect on what properties *B* has.[44]

(I have formulated this as a biconditional, but one may read Mellor as simply offering an ad-
ditional *necessary* condition on parthood, without making the claim that (a) and (b) are jointly
sufficient. This is discussed at the end of the section.)

Before moving on to more sophisticated worries, let me register one general concern. It
would weaken the case for the working-parts view if the criterion fitted badly with our intuitions
concerning what is a part of what. It is not clear to me that the working parts condition as
currently formulated tracks intuitive verdicts appropriately.[45] *If* the criterion of success for the

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[44]The formulation of (b) may well be influenced by one's overall view of the metaphysics of causation. I suppose
that any required reformulation can be given without too much fuss.

A natural worry to have is that any given subatomic particle is unlikely *by itself* to have a significant causal
affect on the properties of the whole. But by condition (b), that seems to exclude all such from being parts. Mellor
responds to this worry by allowing particles to count as having a significant causal impact if they are part of a
plurality of things that collectively have significant causal impact on the whole. To fully explore this would require
a detailed study of the 'cross-level' causal relation to which Mellor appeals, and I will not pursue this task here.

[45]If I am stabbed with a dagger, then the blade of the dagger is (I suppose) contained within me. Moreover,
clearly the dagger's hardness and sharpness will have a causal influence on the properties of my body: after all,
it's slowly killing me. But is the dagger blade part of my body? It would seem odd to say so. Of course, one
might challenge the case. One might argue that the dagger displaces me from a location I used to occupy, and so is
not contained within me: but that, I think, weakens the case against the extreme locationist who is revisionary of
ordinary containment verdicts. Or one might argue that the dagger is part of me, but that we don't usually count
it as such, say because it is not an *organic* part of me: but that, I think, weakens the case against the extreme
locationist who is revisionary of ordinary parthood verdicts. Such cases can be multiplied: think of a person who
is dying of a bacterial infection. The bacteria are intuitively contained in the body, and are certainly collectively
having an impact on the properties of the whole. Such bacteria should be definitely part of the body, by the above
criterion. But one might think that a bacterium should not be regarded as part of my body: it is an alien invader.
(Thanks here to Raul Saucedo for suggesting this second case to me.) For what it is worth, my verdicts in these
kind of cases are somewhat malleable: but it is worth making the point that the working parts condition looks to
impose a *completely definite* verdict on the case, which fits badly with the attractive thought that the matter is a
vague or context-sensitive one. It may be that these are the sort of 'hard cases' that Mellor refers to in §6. He takes
it to be a virtue of his theory that it resolves such cases *resolve*.

working parts condition is to by-and-large track folk verdicts about parthood, it may well be that the story needs to be tweaked or extra necessary conditions on parthood added.

I turn now to the question of whether requiring that (a) and (b) be *necessary* for parthood does the work that Mellor wants it to: for example, disqualifying transitory particles from being parts of Window. The thought, I take it, is that though the particles may have some slight local effect on my body (perhaps transient charged particles will alter the electro-magnetic field in my vicinity and so have some slight impact on chemical changes in my body), they do not have *significant* effects.

This idea needs to be handled with care. *A* might have a significant effect on *B* which is part of *C*, while *A* does not having a significant effect on *C*. Perhaps *A* is some transitory particle, affecting the electro-magnetic field in the vicinity of a molecule in such a way to influence its interactions, but only in ways that are insignificant at the macro-level. If this can happen when *A* is contained in *B* (when the particle is passing through the molecule), we have the following situation: *A* will meet the conditions for being part of *B*, and *B* is part of *C*: but *A* fails the conditions for being part of *C*.

If such scenarios arise (and I cannot see how the working parts theorist can rule them out) then given the working parts view we can generate a failure of the transitivity of parthood. That is unwelcome: transitivity is a standard part of mereology, and something that Mellor himself accepts.[46]

A dilemma for the working parts theorist can then be constructed. On the first horn, our project is to analyze that transitive relation that figures in formal theories of mereology and to which Mellor appeals in his work. If so, the working parts condition is threatened by counterexamples of the $A - B - C$ form.

On the second horn, what we are analyzing is not that relation, but another, which we might call 'proto-parthood'. Parthood proper is the transitive closure of this relation (and perhaps it's indeterminate whether our ordinary intuitions track proto-parthood or parthood). But, if this is right, then even though transitory particles are not *proto-parts* of the window, they may yet be *parts*, if they meet the working parts condition with respect to any of the smallest parts of the window that they past through. But this cuts against Mellor's original motivation for imposing

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[46]It is important to his account that it is so: see his footnote 4.

the working parts condition, which was exactly to deny such transitory particles the status of parts of Window.

Three things should be noted, however. First, the transitive closure of proto-parthood characterized via the working parts condition need not coincide with simple containment: indeed, it is presumably a empirical matter whether the $A - B - C$ case described above ever actually arises. Second, if ordinary intuitions track proto-parthood rather than parthood proper, then the working parts characterization of proto-parthood will indeed explain the counterintuitiveness of calling transitory particles a part of Window: so even if the case is no longer a *counterexample* to the extreme locationist, it might be that only the working parts, moderate, locationism, has the explanatory resources to account for the case. Third, *even if* we end up counting transient particles as parts of Window, that will not undermine the working parts view, if there are grounds *other than* intuitions about particular cases for favouring it over extreme locationism.[47]

Let us return to the formulation of the working parts view. To this point, we have been assuming that containment and the working parts condition were intended to be *jointly sufficient* for parthood. But that could be denied. The moderate locationist could hold that *other*, as yet undreamt of, conditions are also required before something counts as a part of another thing. And it might be those conditions that exclude the dagger from being a part of me, or the transient particle from being a proto-part of Molecule, and hence a part of Window.

But if that view is adopted, doesn't the moderate locationist owe us an account of what these further conditions are? This raises anew the question of *why* the moderate locationist feels burdened to spell out illuminating conditions for parthood in the first place (as opposed, for example, to simply making the supervenience claim that fixing all locational and causal properties fixes the part-whole relations). In general, philosophers don't usually feel burdened to try to give illuminating necessary and sufficient conditions in elite terms for each concept they deploy (what would be the analysis for 'chair'?). The context-sensitivity, vagueness, or response-dependence of many ordinary concepts might be thought to be systematic barriers to

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[47]In illustration of the last point, notice that many philosophers hold that distinct things can be *exactly* collocated (perhaps the statue/clay puzzles could be used to argue for this possibility; or perhaps one holds that it is a physical possibility that two point-particles be so related). Each of the collocated objects is (improperly) contained within the other. But that would make them parts of one another: from which it follows on standard treatments of mereology that the entities are identical. We shall see other reasons for believing in a moderate locationism, and in the working parts condition in particular, in the next section.

such projects. Why should 'parthood' be any different?

This suggests two fundamentally different ways of conceiving of the project in which the moderate locationist is engaged. The *ambitious* project would attempt to give illuminating necessary and sufficient conditions for a basic mereological notion, perhaps defending something close to the working parts view discussed in this section. The *minimal* project doesn't have the ambition of spelling out a criterion for parthood. Rather, they are content, in the first instance, simply to make the claim that (non-elite) parthood facts supervene on non-mereological facts: facts about location, causality etc.[48] Some special motivation would then be needed to push them to go further than this.

If I were a locationist, I would be a minimal moderate locationist. Nevertheless, I would feel compelled to endorse something like the working parts condition as a necessary constraint on proto-parthood, for reasons to be discussed in the next section.

8   A new motivation for the working parts view

The part-whole relation demonstrates a certain *stability* over time: if I waggle my foot, my toes waggle along with it—they don't get 'left behind'. In connection with this, Mellor says:

> when a thing moves, it does not move because its parts do: they move because it does, simply because nay part that stays behind will thereby cease to *be* one of its parts. (Mellor, ming, §2)

This is absolutely right, of course: the locationist faces no challenge to explain why *parts* are carried along with an object: for anything that does not get carried along just won't count as a part. However, we can pose the question in a slightly different fashion, which will exclude such points. We ask: why is it that my *toes* move along with my *foot*, all else equal?

Now, it is tempting at this point to say something like:

> the toes are just parts of the foot, the foot is *the sum of* the toes, heel, and so forth. Given that intimate relation, what more is there to explain?

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[48]See Hawley (2006) for defence of an intermediate project: one that would give necessary and sufficient conditions for composition, but only relative to this or that kind.

That is, it is tempting to appeal to the part-whole relation to *explain* the correlation between the locations of toes and foot.

Consider what this putative explanation looks like to the extreme locationist. We ask about why the locations of toes and foot are correlated, and are told that it is because one is part of the other. But what it is for the latter to hold is just for the toes to be contained within the foot. So we would be explaining the correlation between locations by means of a correlation between locations—no advance at all.

Now one possibility is that the locationist simply lacks the wherewithal to explain these *de re* correlations between parts and wholes. To the extent that they demand explanation (something that a Humean, for example, might deny) then this is an objection to that view.

But one might think that explanations of the correlation are available that do not allude to parthood at all. Suppose, for example, that there are causal connections between the states of my toes at one time, and the states of the foot at a later time: that manipulating the locations and orientations of my toes is a way of *causing* the foot to have a certain location and orientation. If that is the case, then surely the correlation between toes and foot is no mystery: just as the correlation in location between locomotive and carriage over time is no coincidence, given that they are hooked together in such a way that manipulating the location of one causes changes in the location of the other.

Not everyone would be a fan of such 'cross-level' causal relations. But if one is to try to explain the correlations in location without any essential appeal to parthood, they seem like the only option around.

Of course, it is exactly these cross-level causal relations that Mellor presupposes and builds into his working parts condition. *If* the working parts condition holds, then it is appropriate to explain *de re* correlations between the locations of parts and whole by appeal to mereological relations: for those relations would code for the causal connections which do the real explanatory work. And so—while the locationist can afford to be somewhat relaxed about what it takes for one thing to be part of another—the theoretically and explanatorily *interesting* relation in the vicinity meets the working parts condition.

9   Nothing but its parts?

The locationist describes a worldview that takes the macro-world with metaphysical serious-ness. Those of us with micro-prejudices are motivated to look again at the alternatives. The partist view, in particular, would be congenial to someone who thought that the real metaphys-ical action occurs at the level of subatomic physics. But we've seen philosophical grounds for unhappiness with that option.

However, two views that were earlier mentioned and set aside should interest the microphys-icalist. One was the mereological logicist, who thinks of composition as an instance of identity; and the microphysical compositional nihilist, who holds there are no genuine instances of the part-whole relation, for the simple reason that compound objects do not really exist at all.

Of these, the latter is, I think, the most promising.[49] The compositional nihilist, unlike the no analysis and partist views, has no trouble with interaction between fundamental mereological and locational relations: for according to him there are no fundamental mereological relations. But unlike the locationist, the nihilist does not need to explain real de facto correlations between instances of the fundamental location relation: for there are no such real correlations.

The obvious objection is that the nihilist view denies obvious 'Moorean' truths: what could be more non-negotiable than the truth that I have hands? But against this, elsewhere I defend the compatibility of commonsense truths medium sized goods with the denial that our ontology contains any such things.[50] It is *true* that a table exists, and is so-coloured and orientated, but all the truth of this *demands* of the world is that subatomic particles be thus-and-so arranged. If that idea can be made good, I think that we have here a position that deserves the slogan 'things are nothing but their parts'. Mellor discusses, and I think rightly dismisses, one precisification of that slogan in his paper. But the compositional nihilist, by denying the real existence of compound objects, has already given content to the claim that things are nothing but their parts, and has no need to make the supervenience claims that Mellor attacks in the paper.[51]

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[49] See Sider (2007b) for discussion of the composition-as-identity (mereological logicist) line.

[50] Williams (2007). The most famous advocate of the compatibility of commonsense with an (almost) nihilist approach is van Inwagen (1990), though it is not clear to what extent he is *defending* the commonsense claims, and to what extent he is showing *how to get by without them*. Another option is the fictionalist explored by Dorr and Rosen (2002); Dorr (2002). My own approach has no truck with revisionary approaches to the syntax and semantics of natural language, but instead advocates an revised account of ontological commitment.

[51] The claims that Mellor uses to articulate the claim that 'things are nothing but the sums of their parts' are perhaps closer to theses arguably entailed by the composition-as-identity view. See Sider (2007b) for discussion.

The working parts locationism that Mellor advocates is a metaphysics where the things folk take to exist really do exist. If the approach fulfils its promise, the overall package will be a powerful one. I commend it, and its nihilist rival, as the two approaches best suited to negotiate the problematic interrelation between mereology and location.[52]

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