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Parts and Wholes

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Abstract

Philosophical questions concerning parts and wholes have received a tremendous amount of the attention of contemporary analytic metaphysicians. In what follows, I discuss some of the central questions. The questions to be discussed are: how general is parthood? Are there different kinds of parthood or ways to be a part? Can two things be composed of the same parts? When does composition occur? Can material objects gain or lose parts? What is the logical form of the parthood relation enjoyed by material objects?

There are a multitude of fascinating philosophical questions about the nature of parts and wholes. In what follows, I discuss some of the central questions, which include: how general is parthood? Are there different kinds of parthood or ways to be a part? Can two things be composed of the same parts? When does composition occur? Can material objects gain or lose parts? What is the logical form of the parthood relation enjoyed by material objects?

These are not the only interesting or important questions about parthood. For example, I will not discuss the questions of whether there are mereological simples – objects that do not have any proper parts – and what the conditions are in which something is a simple, as another *Philosophy Compass* article directly addresses them.[1] For similar reasons, I will merely briefly discuss the issue of whether objects have temporal parts.[2] I also will not try to settle here which answers to these questions are the most plausible, let alone true, and I cannot even promise to mention every response to these questions currently present in the literature. Instead, I hope that as I give the reader an overview of some of the terrain, she will be motivated to map it further herself.[3]

The following definitions will be helpful in what follows:

x overlaps y =*df*. There is a z such that z is a part of x and z is a part of y.

The xs compose y =df. Each of the xs is a part of y; nothing is a part of y unless it overlaps one of the xs.

y is a sum of the xs =*df*. The xs compose y.[4]

Let us turn now to the questions!

1. How General is Parthood?

A feature is general to the extent that it can be exemplified by objects of a variety of sorts or kinds. The maximal degree of generality is *topic-neutrality*: a topic-neutral feature is one that can be exemplified by objects from any ontological category. A plausible example of a topic-neutral feature is *identity*. Objects of all sorts can bear the identity relation to themselves: mountains can be self-identical as can propositions, numbers as well as gods. Is parthood topic-neutral? Or can parthood be exemplified only by objects of some categories, such as material objects or regions of spacetime?

Ordinary language suggests that parthood is topic-neutral or at least highly general. Each of the following attributions of part/whole structure seems acceptable:

(1) The first measure is a part of the song.
(2) 12:30 PM is a part of the interval ranging from 12:00 PM to 1:00 PM.
(3) This part of space is curved.
(4) The third inning was the most boring part of the baseball game.
(5) The weakest part of his argument is where he confuses types and tokens.
(6) Part of what he did when he killed the butler was hit him with a candlestick.

The first sentence ascribes part/whole structure to abstract types, the second to intervals of time, the third to regions of space, the fourth to events, the fifth to arguments, and, finally, the sixth sentence ascribes part/whole structure to actions. Each of these sentences seems perfectly intelligible, and we can envision contexts in which we would sincerely endorse something like them.[5] Examples like these suggest that parthood is topic-neutral, or at least enjoys a high degree of generality.

We need to be careful when assessing the question of whether parthood is topic-neutral that the question does not become trivialized. Many metaphysicians employ a notion of parthood in which every object is counted as a part of itself. (It is perhaps fair to say that this notion of parthood does not correspond to the ordinary notion of parthood in this respect.) Note that, given this conception of parthood, it is trivially true that the concept of parthood is topic-neutral, as identity is universal. Item (2) definitely has parts, as it at least has itself as a part! So forth for objects of other ontological categories. Our interesting question is in danger of being trivialized!

Let us say that *x is a proper part of y* just in case *x is a part of y but not identical with y*. (The ordinary notion of parthood is presumably the notion of proper parthood characterized here.) We could avoid the danger of trivialization by asking whether the concept of proper parthood is universal, that is, by asking:

> Q1: Does every entity, regardless of which ontological category it belongs, have proper parts?

But Q1, although interesting, is not the intended question. A better way to understand the question of whether parthood is topic-neutral is to understand it as:

> Q2: Does every ontological category have at least one member that has a proper part or is a proper part of something?

If within every category we can find complex wholes, then parthood is topic-neutral in the intended sense. David Lewis champions the view that parthood is topic-neutral. According to Lewis (1991), the notion of parthood is maximally general. Lewis endorses *compositional universalism* (a view that we will revisit in Section 4), according to which whenever there are some entities, there is something composed of them. If there are two *sets*, for example, the set of donkeys and the set of human heads, there is an entity made of those two sets. According to Lewis (1991), this entity is a set itself. If there is a number and a cat, then there is something composed of that number and that cat. Some might find this troubling or perplexing.

Of course, if it is not a conceptual truth that everything is a part of itself, then our task is much easier. We can, if we like, introduce a defined notion of *improper parthood* whereby *x* is an *improper* part of *y* just in case *x* is numerically identical with *y*. We can turn our attention to the simpler question of whether any entity, regardless of which ontological category it belongs, has parts.[6]

Although ordinary language suggests that parthood is highly general, it is worth noting that some putative ontological categories seem to resist the attribution of part-whole structure to their members. For example, suppose that numbers form an ontological category. There are no commonsensical attributions of part-whole structure to numbers. The sentence, '.33 is a part of 3.33' sounds silly. Or consider the putative category *possibilities*. The sentence, 'the possibility that Ben wins the chess match is part of the possibility that Ben wins the chess tournament', sounds strained. This, of course, does not show that the concept of parthood is not topic-neutral. It might be the case that there are composites made out of numbers and possibilities, or that numbers and possibilities are composite objects. Or it might be that neither numbers nor possibilities form genuine ontological categories. But the case for parthood being topic-neutral would be stronger if we could produce plausible sounding attributions of mereological structure to entities of every putative ontological category.

One reason to be interested in the question of the topic-neutrality of parthood is that it relates to the question of whether parthood is reducible to some other relation. Suppose, for example, that parthood is instantiated only by entities that have a spatiotemporal structure. If this is the case, then some of the sentences mentioned earlier must be construed as metaphorical if true or false if literal. However, a view like this does raise the possibility that parthood might be reducible along the following line: x is a part of y if and only if either (i) x and y are regions of spacetime and x is a subregion of y or (ii) there are regions of spacetime R1 and R2 such that R1 is a subregion of R2, x is located at R1, and y is located at R2. Now, there might be reasons to object to this reduction. (For example, this reductive account of parthood seems to imply that non-overlapping co-located material objects are impossible, for were they to exist, it would follow that they were parts of each other.) But the point is that the possibility of a reduction of this sort, one that reduces the notion of parthood to spatiotemporal notions broadly construed, looks closed off if parthood can apply to objects that lack spatiotemporal structure (as abstract types, arguments, or classes apparently do.)[7]

As mentioned earlier, David Lewis (1991) holds that parthood is topic-neutral and moreover holds that the axioms of *classical mereological* govern the parthood relation. Classical mereology can be formulated as the conjunction of three axioms: compositional universalism, the extensionality of parthood (x is identical with y if and only if they have exactly the same parts), and the transitivity of parthood (if x is a part of y and y is a part of z, then x is a part of z). Lewis applies classical mereology not only to material objects but also to sets. Gabriel Uzquiano (2006) argues that, on certain reasonable assumptions, taking classical mereology to be maximally general as Lewis does leads to a contradiction as classical mereology and standard set theory provide inconsistent answers to the question 'how many things are there?'[8]

2. Are there Different Kinds of Parthood or Ways to Be a Part?

Perhaps *parthood* is a highly general or even a topic-neutral feature. But it would not follow from parthood's being general that there are not different modes or ways of being a part. Perhaps the kind of parthood exemplified by material objects is not the kind of parthood exemplified by regions of spacetime.

Following McDaniel (2004, forthcoming), *compositional monism* is the view that there is exactly one fundamental parthood relation. Compositional monism is consistent with the view that there are many non-fundamental parthood relations, for example, *causally*

integrated parthood, *functional parthood*, and *immediate parthood*. But each of these non-basic relations is *definable* in terms of a more basic notion of parthood and other non-compositional concepts:

x is a *causally integrated part of y =df.* *x* is a part of *y* and each of *x*'s parts is robustly causally related to every other part of *x*.

x is *functional part of y =df.* *x* is a part of *y* and *x* plays some functional role in the production of some state of *y*.

x is an *immediate proper part of y =df.* *x* is a proper part of *y* and there is no other proper part of *y*, *z*, such that *x* is a proper part of *z*.[9]

Following McDaniel (forthcoming), we distinguish between two versions of compositional monism. Say that a parthood relation is a *fundamental parthood relation* just in case it is not analyzable in terms of some other parthood relation. *Weak compositional monism* is the view that there is one fundamental parthood relation, whereas *weak compositional pluralism* is the view that there is more than one fundamental parthood relation. Say that a parthood relation is fundamental *simpliciter* just in case it is not analyzable in terms of any other property or relation. *Strong compositional monism* is the view that there is exactly one such relation, whereas *strong compositional pluralism* is the view that is more than one parthood relation that is fundamental.[10]

Here are some reasons to be interested in whether compositional monism is true. First, many of the other metaphysical questions about parthood become much more complicated if compositional pluralism is true. One of the questions concerning the metaphysics of material objects that has occupied metaphysician's attention is the *Special Composition Question*, which asks under what circumstances some objects compose a whole. (We will revisit the Special Composition Question in Section 4.) If there is more than one kind of parthood relation, there is more than one kind of composition relation. (Recall that in the introduction, we showed how one can define *composition* in terms of *parthood*.) If there is more than one composition relation, then we should distinguish the question of when one of them is exemplified from when one of the other is. Similarly, *the simple question*, raised explicitly by Ned Markosian (1998a), asks under which conditions an object lacks proper parts. If there is more than one way to have a part, there is more than one way to lack them. So if compositional pluralism is true, we must distinguish various simple questions.[11]

A third reason to care about compositional pluralism is that many philosophers are attracted to the view that composition is strongly analogous to identity.[12] Some even suggest that the composition relation might just be the identity relation.[13] Here is a stock example, drawn from Donald Baxter (1988a), which motivates this view. A farmer divides his farm into six plots, and sells each part of his farm to a different person. He then tries to sell the whole farm. Something has gone wrong. But if the farm is not identical to the six plots, then it is one thing to sell the plots and another to sell the farm. This example suggests that the composition relation is just the identity relation, and so the six plots are just the farm.

However, if some form of compositional pluralism is true, there is no relation that is *the* composition relation, as there is more than one. But arguably there is not more than one identity relation. So if compositional pluralism is true, the view that composition is identity, or even strongly analogous to identity, is hard to defend.[14]

There are several ways to be a compositional pluralist. There is a view we can call *categorical pluralism*, which holds that there are different notions of parthood, each of which is appropriate to distinct ontological categories. McDaniel (2004) defends a kind of categorial pluralism, according to which the fundamental parthood relation enjoyed by material

objects is not identical with the fundamental parthood relation enjoyed by regions of spacetime.

A more radical kind of compositional pluralism holds that there is more than one parthood relation enjoyed by objects within a given ontological category. Armstrong (1997) appears to defend this sort of view, as he allows that facts can participate in a general kind of composition he calls *mereological* as well a kind that pertains only to them. Kit Fine (1994) distinguishes between two kinds of composition, which he calls *aggregation* and *compounding*.[15] These generate wholes with different kinds of identity conditions. Finally, Daniel Korman (unpublished manuscript) argues that if we distinguish different kinds of composition relations defined on material objects, we can solve certain problems facing the view that two material objects can be made of the same parts. (We will discuss whether two material objects can share the same parts in the next section.)

In what follows, we will set aside concerns about whether parthood is topic-neutral and whether compositional pluralism or monism is true. We will focus on questions about the parthood relation as it applies to material objects, and we will assume that there is only one such relation. Doing so unavoidably means that important considerations will be ignored, but unless we restrict our focus in some way, the issues to be explored will be unmanageably numerous.

3. Can Two Things be Composed of the Same Parts?

Consider some collection of atoms. Is it possible for two material objects to be made out of these atoms at the same time? Initially, the answer seems to be 'no', as if there were such objects, they would be at the same place at the same time. But there are considerations in favor of answering 'yes'.

Consider the following case. Linda holds in her hands a lump of clay, which we will call 'Lumpy'. Linda molds the lump until she is satisfied with the statue of a human being that she has made. Call the statue, 'Stan'. Call the moment at which Linda is satisfied with her statue '*t*'. The following argument has moved many philosophers to hold that there can be two objects that are composed of the same parts at the same time:

(i) Lumpy exists at *t* and can survive being squashed by Linda.
(ii) Stan exists at *t* but cannot survive being squashed by Linda.
(iii) If (i) and (ii), then Lumpy is not identical with Stan.
(iv) So Lumpy is not identical with Stan.
(v) Lumpy and Stan both exist at *t* and are composed of the same parts at *t*.

:. So there can be two objects that are composed of the same parts at the same time.[16]

Premises (i) and (ii) are supported by appeals to intuition. It seems that lumps of clay can persist through time even when their shape has changed. Perhaps lumps of clay cannot survive as scattered objects, but they can be flattened or stretched. Molding a lump of clay *alters* the clay but does not destroy it. However, a statue – a work of art – cannot persist through time if its shape has been radically altered. Stepping on a statue *destroys* the statue.

Premise (iii) is supported by an appeal to Leibniz's Law, which states that *x* is identical with *y* if and only if *x* and *y* share all the same properties. If Lumpy can survive in a situation in which Stan cannot, then Lumpy and Stan differ with respect to at least one property, specifically, the modal property *x is possibly squished*.

Before discussing the rationale for premise (v), we should carefully examine what is meant by 'Lumpy and Stan are composed of the same parts at the same time'. One thing that could be meant is this:

(SP1): For all *x*, *x* is a part of Lumpy at *t* if and only if *x* is a part of Stan at *t*.

But there are reasons to dislike this reading. Recall that everything is a part of itself. So Lumpy is a part of Lumpy and Stan is a part of Stan. But then by SP1, Lumpy is a part of Stan and Stan is a part of Lumpy. As Lumpy is not identical with Stan, Lumpy is a proper part of Stan and Stan is a proper part of Lumpy. As proper parthood is a transitive relation, it follows that Stan is a proper part of Stan. This seems like a bad consequence: it is ok to say that a whole is a part of itself, but it does not seem ok to say that something is a *proper* part of itself.

A second way of reading 'Lumpy and Stan are composed of the same parts at the same time' is this:

(SP2): For all *x*, *x* is a *proper* part of Lumpy at *t* if and only if *x* is a *proper* part of Stan at *t*.

SP2 does not imply that Stan and Lumpy are parts of each other. Let us understand premise (iv) in accordance with SP2. So understood, premise (v) seems intuitive: *t* is the moment at which a statue was dubbed 'Stan', and Stan is that statue, so Stan must exist at *t*.[17] If Lumpy can survive being squished, then Lumpy should be able to survive being molded into the shape of a statue.

Although this argument seems plausible, there has been resistance. One response is to deny that either Lumpy or Stan exists. Peter van Inwagen (1990b) defends the view that there are no non-living composite material objects; an even more radical view, championed by Gideon Rosen and Cian Dorr (2003), is compositional nihilism, the view that there are no composite objects.

Michael Burke (1994a, 1994b) and Michael Rea (2000) pursue the less radical strategy of denying premise (i). According to them, Lumpy does not exist at *t*. Although it is true that Lumpy can undergo many changes, one change that Lumpy cannot undergo is becoming a statue. Statues, on their view, are necessarily statues, and so anything that is not a statue is necessarily not a statue. At *t*, Lumpy expires and is *replaced* by Stan the statue.

Similarly, one might argue that premise (ii) is false. Strictly speaking, when one manipulates clay, one merely rearranges that which already exists. One does not create anything new, and so no separate entity is brought into existence at *t*. Perhaps at *t*, Linda gives Lumpy a new name and adopts the convention that Lumpy will enjoy the name 'Stan' only so long as Lumpy is shaped as a statue. But, on this picture, Linda made nothing new.

Finally, some argue that premise (iii) is not really an instance of Leibniz's Law, and therefore can safely be rejected. This is the strategy pursued by Harold Noonan (1991), who argues that modal predicates such as 'can survive being squashed' are systematically equivocal: they express different properties depending on which subject terms they are appended to. Similarly, David Lewis (1971, 1986: 254–63) argues that the correct analysis of modal predication is *counterpart theory*, which undermines premise (iii). Very roughly, counterpart theory is the view that an object *x* can be *F* just in case there is some *y* such that *y* is a counterpart of *x* and *y* is *F*. For one object to be a counterpart of the other is just for the first object to be sufficiently similar to the second. But of course whether one can truthfully say that '*x* is similar to *y*' depends in part on the context in which such statements are uttered: different respects of similarity are invoked in some contexts that are not salient in others. Although Stan is identical with Lumpy, when we think of Stan

as Stan the statue, and use the proper name 'Stan', we are unwilling to count non-statue-shaped entities as being similar enough to Stan/Lumpy to be its counterparts. So we can truthfully say, in these contexts, that Stan cannot be flattened. But when we think of Stan/Lumpy as Lumpy the Lump, we invoke a different respect of similarity, and thereby can truthfully say that Lumpy could be flattened. But on Lewis' view, just as it is not inconsistent to say in one context that Lumpy is similar to some *x* but in another context deny that Stan is similar to that *x*, so too it is consistent to claim in one context that Stan is essentially statue-shaped while denying in another context that Lumpy is essentially statue-shaped, although Stan is identical to Lumpy.

Those who accept coincident entities such as Stan and Lumpy also face the question of explaining how Stan and Lumpy can differ with respect to their modal properties even though they are seemingly indiscernible with respect to their non-modal, non-intentional properties. This problem is sometimes called the *grounding problem*.[18]

4. When does Composition Occur?

Peter van Inwagen's masterful book *Material Beings* re-introduced the question of when wholes exist as the *Special Composition Question*. Since then, discussion of the Special Composition Question has received tremendous attention.

Informally, the Special Composition Question asks, 'Under what circumstances do some objects compose a whole?' Less informally, the Special Composition asks: what way of filling in the following schema yields a true and informative statement?

The *x*s compose a *y* if and only if _____.

Van Inwagen's own answer to the Special Composition Question is:

(Life): The *x*s compose a *y* only if the activities of the *x*s constitute a life.

According to van Inwagen, something is a composite object only if that thing is *alive*; every material object is either a mereological simple or a living organism. Strictly speaking, there are no tables, chairs, rocks, or automobiles, but there are cells, plants, puppies, and people.

van Inwagen's proposed answer does not seem terribly commonsensical, so it is natural to wonder why he endorses it, and what the other possible answers to the Special Composition Question might look like.[19] In *Material Beings*, van Inwagen discusses and argues against several proposed answers to the Special Composition Question, which include:

(Contact): The *x*s compose an object *y* if and only if the *x*s are in contact.[20]

(Fastening): The *x*s compose an object *y* if and only if the *x*s are fastened together.[21]

(Nihilism): The *x*s compose an object *y* if and only if there is exactly one of the *x*s.[22]

(Universalism): The *x*s compose a *y* if and only if the *x*s exist.[23]

Nihilism and universalism are *extreme* answers to the Special Composition Question in that they imply that either composition never occurs or composition always occurs. The other answers on this list, and van Inwagen's own answer, are *moderate* answers to the Special Composition Question in that they imply that sometimes composition occurs and sometimes composition does not occur.

van Inwagen argues that the other moderate answers raise thorny philosophical questions that Life does not face. For example, consider contact. Suppose two people come into contact. Perhaps they shake hands. According to contact, they now compose something. They cease to shake hands, and thus cease to compose anything. After a brief conversation, they shake hands again, and again compose something. Is the thing that they compose now the thing that they composed minutes ago? (Is it not a little weird that there is something that is made up of you and I whenever we hold hands?)

van Inwagen's argument against nihilism is relatively quick but forceful nonetheless: I exist, and am a composite, material object. So there is at least one composite object. So nihilism is false.

van Inwagen's argument against universalism is lengthier. Here is a compressed version of the argument. Consider, for example, yourself, who van Inwagen takes to be a living human organism. The atoms that composed you 10 years ago still exist, but none of them are among the atoms that compose you now. If universalism is true, then there was something made out of those atoms then and there is something made out of those atoms now. van Inwagen suggests that, if universalism is true, the object made out of those atoms then must be identical with the objects made out of those atoms now, for if wholes are 'automatically generated' by their parts, as universalism alleges, it is hard to see how merely changing the arrangement of these parts could cause the whole to cease to exist. So the atoms that composed you 10 years ago must compose you today. We have reached a contradiction, and so universalism must be false.

van Inwagen's book has spawned an enormous literature. Some of it consists of attempts at defending Life or something like it; Trenton Merricks' (2001) book *Objects and Persons* is an impressive brief for the non-reality of inanimate material beings. Some of the literature consists of defenses of the views that van Inwagen targets. For example, Michael Rea (1998) argues that universalism does not imply, pace van Inwagen, that material objects never gain or lose parts. Of course, some of the literature consists of attacks on Life itself. Some, such as Markosian 1998b, have argued that there is no finitely stateable and non-trivial answer to the special composition question.

Perhaps the most popular worry about Life and other moderate answers to the Special Composition Question is the *argument from vagueness*. This argument was first raised as an argument for universalism by David Lewis (1986: 212–13). Lewis' argument has since been developed by Theodore Sider (2001: 121–32). Here I can only present a brief, rough statement of the argument. Consider Life. It is sometimes indeterminate whether something is alive: it is indeterminate, for example, when human life begins and when it ends, and it is probably indeterminate whether viruses are alive. Our concept of what it is to be alive is simply vague. More generally, it seems that any plausible moderate answer to the Special Composition Question will be a vague answer in that, with respect to some possible cases, it is indeterminate whether the necessary and sufficient conditions for composition are obtained in those cases. If necessarily *P* if and only if *Q*, and it is indeterminate whether *P*, then it must be indeterminate whether *Q*. But how can it be indeterminate whether something exists?[24]

5. Can Material Objects Gain or Lose Parts?

Mereological constantism is the view that if it is ever the case that something x is a part of something y, then it is always the case that, if y exists, then x is a part of y. *Mereological essentialism* is the view that, if x is a part of y, then necessarily, if y exists, then x exists and is a part of y. Mereological constantism is the view that objects do not gain or lose parts; mereological essentialism is the view that they cannot.[25]

Here is an argument that motivates mereological essentialism. Consider a human being, Fred, and the part of Fred that is all of him except for his left toe, which we call Ed.[26] At t, Fred and Ed are not identical, as nothing is identical to one of its proper parts. At $t2$, Fred has a terrible accident involving a lawnmower, and loses his left toe. Ed is undisturbed, and in fact undergoes no serious intrinsic change. Rather, something adjacent to Ed is no longer adjacent to it. At $t2$, if Fred and Ed both exist, then they are made of the

same parts. But it is not possible for two things to be composed of the same parts at the same time. So it is not the case that both Fred and Ed exist at *t*2. As Ed underwent no intrinsic change from *t*1 to *t*2, it seems that Ed must still exist. (How could the removal of some *x* that is not a part of some *y* metaphysically necessitate the destruction of *y*?) So Fred must have gone out of existence. So people cannot survive the loss of their left toes, which is surprising. One possible explanation for this putative fact is that mereological essentialism is true. If in general things cannot survive the loss of a part, it follows that Fred cannot survive the loss of his toe. Relatedly, if Fred cannot survive the loss of a toe, it is hard to see what grounds there are for holding that there are some parts that Fred can survive the loss of.

A related argument concerns the acquisition of parts.[27] Suppose that, at *t*, a wall is made of five bricks. Call the wall *Wally*. Wally occupies a bit of space that we will call *R*. At *t*2, a sixth brick is added to the wall, making it larger than it was before. But surely there is still something made of the five bricks: we can even see it, and can clearly describe its shape and many of its other intrinsic and extrinsic properties. Call this thing *Wall-*. Wall- occupies *R* at *t*2. From *t* to *t*2, nothing appeared to undergo any interesting change in the region *R*. Instead, a material object (the sixth brick) was placed in a region merely adjacent to *R*. It is hard to see how placing an object in one region could bring about the creation of a new object in a merely adjacent region. So it seems that Wall- must not have been created at *t*2. So Wall- must have existed at *t* as well. But if both Wally and Wall- exist at *t*, then they are made of the same parts at *t*. But nothing can be made of the same parts at the same time.

We have derived a contradiction. One way to avoid the contradiction is by denying the assumption we began with, specifically, that objects can gain parts. There are of course other possible responses to this puzzle. As noted earlier, some philosophers believe that material objects can be made of the same parts at the same time. Perhaps Wally and Wall- are examples of such material objects. Of course, someone who endorses *Life* will deny that there are material objects such as Wally and Wall-.[28]

Part of what motivates the existence of Wall- is a doctrine that Peter van Inwagen (1981) has called *the Doctrine of Undetached Parts* (DAUP), which can be formulated in the following way:

> (DAUP): Necessarily, for every material object M, if R is the region of space occupied by M, and if sub-R is any occupiable sub-region of R whatever, there exists a material object that occupies the region sub-R and which is a part of M.[29]

Roughly, DAUP says that, for any way of dividing up the region of space occupied by an object into parts of that region, there are corresponding parts of the material object.[30] If Wally exists at *t*2, DAUP implies that there is a material object that occupies *R* at *t*2 as well. If we give up DAUP, it is not obvious what else could be used to motivate the existence of something like Wall-. It is true that we appear to see Wall-, but we also appear to see any of the macroscopic objects whose existence is implied by DAUP, and some of these fail to exist if DAUP is false.[31]

6. What is the Logical Form of the Parthood Relation Enjoyed by Material Objects?

Some philosophers hold that material objects have temporal as well as spatial parts. Just as objects extended through space have spatial parts that correspond to the sub-regions of the regions they object, objects are extended through time as well, and have temporal parts corresponding to the sub-intervals of the duration of time through which they

persist. Roughly, something x is a temporal part of y just in case there is some interval of time such that (i) x persists throughout that interval but exists at no other times, (ii) x and y occupy the same places throughout that interval, and (iii) x is a part of y throughout that interval. According to the doctrine of temporal parts, whenever an object persists through time, it does so by having a temporal part that occupies that time. An example of an alleged temporal part is the part of me that existed exactly on the moment that I turned 30 years old.[32]

Whether objects have temporal parts is relevant to the question of what the logical form of the parthood relation enjoyed by material objects is. One aspect of the logical form of a feature is its *adicity*, that is, the number of entities necessary to fully saturate the feature. Monadic features are saturated by exactly one entity, two-place relations require two entities to fully saturate them, and so forth. Most friends of temporal parts hold that the basic parthood relation defined on material objects is a two-place relation: x is a part of y *simpliciter*. Just as the first inning of a baseball game is a part of the baseball game simpliciter, rather than being a part of it at some times but not others, so too the momentary temporal part that occurs on the first moment of my 30th birthday is a part of me simpliciter.

In contrast, many foes of temporal parts take the parthood relation to have a three-placed logical form, with the third slot reserved for times.[33] On their view, the fundamental parthood relation enjoyed by material objects is: x is a part of y at t.

Whether parthood is temporally relativized in this fashion has some impact on other debates about parthood. One salient example concerns the proper formulation of *mereological extensionality*, roughly the doctrine that things with the same parts are identical.[34] If you believe that parthood is a two-place relation, a natural way to formulate extensionality is as follows:

ME1: If for all z, z is a part of x iff z is a part of y, then x is identical with y.

However, if you hold that the parthood relation is three-placed, two different ways to formulate extensionality seem equally natural:

ME2: If for all z and for all t, z is a part of x at t if and only if z is a part of y at t, then x is identical with y.

ME3: If for some t, every z is such that it is a part of x at t if and only if it is a part of y at t, then x is identical with y.

Informally, ME2 says that objects are identical when they have the same parts every time, whereas ME3 says that objects are identical when they have the same parts some time.

ME2 and ME3 are not equivalent. A lump of clay that later coincides with a numerically distinct statue would be a counterexample to ME3, but not a counterexample to ME2. Counterexamples to ME2 must at the minimum exist at exactly the same times throughout their career.[35]

There are other views on the logical structure of parthood worth considering. Hud Hudson (2001) defends a view that he calls *partism*, according to which material objects have parts relative to regions of space and time, or alternatively, regions of spacetime. On the former view, the logical form of parthood is four-placed rather than three-placed, and on the latter view the parthood relation is three-placed but the third relation is a region of spacetime.

Hudson (2001) is motivated to accept partism because of its apparent success in dealing with *the problem of the many*.[36] Here is a rough statement of the problem of the many: you are composed of a cloud of sub-atomic particles, the *ps*. But there are other clouds of particles in your vicinity that overlap the *ps* substantially. Some of these clouds contain all of the members of the *ps* save one sub-atomic particle, which is replaced by a different

nearby particle. Any of these clouds of particles seem to be equally apt to compose something as the cloud that composes you. So they must compose something. Any of these composite objects seems equally apt to be a person as you do. So they must be persons as well. So where it looked like there was one person in that chair, there are far too many.

Consider two of these groups of particles, the *p*s and *q*s. Suppose that the *p*s occupies R1 whereas the *q*s occupies R2. The *p*s are not the *q*s, as some of the *p*s are not identical with any of the *q*s. However, as Hudson points out, if parthood is also relative to regions, the *p*s might compose the same material object as the *q*s. The *p*s compose you relative to now and the region R1, whereas the *q*s compose you relative to now and the region R2. On Hudson's partist solution, each of the many problematic persons is actually identical.

Interestingly, although Hudson recommends partism, he also recommends that the partists believe in something like temporal parts. From a different perspective, one less friendly to temporal parts, McDaniel (2004) recommends that the parthood relation be relativized to spacetime regions to accommodate special relativity, while Ted Sider (2001) suggests that the foe of temporal parts should relativize parthood to regions to solve puzzles about the possibility of time travel.

7. *Concluding Remarks*

Appropriately enough, we have covered only a mere proper part of the extant literature on parts and wholes. I hope that the reader has seen enough of the whole to have been intrigued and perhaps pursue more in the future.[37]

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Short Biography

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Notes

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[1] See Hudson (2007).

[2] The *Philosophy Compass* article by McGrath (2007) addresses questions concerning temporal parts. For more on temporal parts, see Gilmore (2007), Heller (1984) and Heller (1990).

[3] Another online resource is Achille Varzii's entry at the Stanford Encyclopedia of Philosophy: http://plato.stanford.edu/entries/mereology/

[4] Peter van Inwagen (1990b) offers slightly different definitions of 'sum' and 'compose'. For our purposes, these differences make no difference.

[5] Peter Simons (1987) stresses this point throughout. See also McDaniel (2004), from which these particular examples come.
[6] Thanks to Gabriel Uzquiano for discussions of this point.
[7] If parthood does not reduce to location, there is an interesting question of what constraints the two relations impose on each other. McDaniel (2007) and Saucedo (forthcoming) argue that the mereological structure of material objects need not match the mereological structure of the region they occupy.
[8] See Hudson (2006) for related discussion.
[9] These examples of defined parthood relations are taken from McDaniel (forthcoming).
[10] Peter van Inwagen (1990b: 19–20) appears to be on the fence with respect to the monism/pluralism question, but seems to lean on the side of a weak pluralism. Peter Simons (1987) appears to endorse at least weak compositional pluralism. Kris McDaniel (2004) endorses strong compositional pluralism. McDaniel (forthcoming) also suggests that Armstrong (1997) is some kind of compositional pluralist. David Lewis (1991) is a champion of strong compositional monism.
[11] Markosian's version of the simple question is stated as the question of when a material object is a simple. This observation does not affect the point here, as on some versions of compositional pluralism, there is more than one parthood relation exemplified by material objects. Daniel Korman (unpublished manuscript) defends such a view.
[12] Those attracted to the view that composition is or is strongly analogous to identity include: Donald Baxter (1988a,b), David Lewis (1991), and Theodore Sider (2007). Foes of composition as identity include: van Inwagen (1994), Merricks (1999b), and McDaniel (2008).
[13] This view is explored in Sider (2007).
[14] Sider's (2007) statement of the doctrine that composition is strongly analogous to identity is formulated as a conjunction of several claims, one of which is that compositional monism is true. One could perhaps combine compositional pluralism with a more moderate view that each composition has features that make it in some way structurally like identity. Thanks to Gabriel Uzquiano for this suggestion.
[15] See also Fine 1999.
[16] Variants of this argument are defended by Baker (1997, 2000).
[17] One might worry that the statue has a part that the lump lacks: perhaps the statue has its left arm as a part, whereas the lump does not (although perhaps the lump has as a proper part a smaller lump of clay coincident with the statue's left arm). I will ignore this worry in what follows.
[18] See Karen Bennett (2004) for a discussion of the grounding problem.
[19] van Inwagen denies that *Life* is in tension with commonsense; see pages 98–107 for a discussion of why he thinks Life is consistent with commonsense.
[20] van Inwagen (1990b: 33–37).
[21] van Inwagen (1990b: 57–60) discusses fastening as well as other answers to the Special Composition Question that hold that composition occurs when some sort of bonding relation is obtained.
[22] Friends of nihilism include Cian Dorr (of Rosen and Dorr 2003).
[23] Friends of universalism include: McTaggart (1921), David Lewis (1986, 1991), Hud Hudson (2001), and Theodore Sider (2001).
[24] van Inwagen discusses the problem of vagueness in *Material Beings*. For further discussion of the argument from vagueness, see Daniel Nolan (2006).
[25] Roderick Chisholm (1976) is the most prominent defender of mereological essentialism.
[26] The argument I am about to give is usually stated with an example involving a cat who loses his tail. I feel bad for the cats, so I am changing it up a bit.
[27] Eric Olson (2006) discusses this and other variants of the paradox of increase.
[28] van Inwagen (1991: 1970) grants that living organism have proper parts that are larger than sub-atomic particles, but denies that they have proper parts larger than cells. For this reason, van Inwagen believes that Life is not subject to the growing paradox.
[29] This formulation of DAUP is slightly different from van Inwagen's in that it makes explicit that the object that occupies sub-R is a part of M.
[30] For more on DAUP, see Carter 1983.
[31] Provided that the parts of the region *could be* occupied by a material object.
[32] For a more precise definition of a 'temporal part', see Sider (1997).
[33] This is the view defended by Mellor (1981), Thomson (1983) and van Inwagen (1990b).
[34] Obviously, whether parthood is a two- or three-placed relation partially determines how various principles governing it should be formulated. See Simons (1987) for a detailed discussion of several systems of mereology, that is, doctrines of the parthood relation.
[35] Ryan Wasserman (2002) exploits this fact to defend some pairs of coincident entities from attack.
[36] See Unger (1980) for a classic statement of the problem of the many. See Wasserman (2003) for a discussion of whether partism succeeds in dissolving the problem of the many.
[37] Thanks to Cody Gilmore, Mark Heller, and Hud Hudson for comments on an earlier draft.

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