Logique & Analyse **212** (2010), 465–482

QUINE, MEREOLOGY, AND INFERENCE TO THE BEST EXPLANATION

JOHN BIGELOW

Abstract
Given Quine's views on philosophical methodology, he should not have taken the axioms of classical mereology to be "self-evident", or "analytic"; but rather, he should have set out to justify them by what might be broadly called an "inference to the best explanation". He does very little to this end. In particular, he does little to examine alternative theories, to see if there might be anything they could explain better than classical mereology can. I argue that there is something important that needs to be explained, namely, the way that properties "travel around in clusters" (eg. we often know that "when and where there is something with such-and-such property, there is also something with so-and-so other property"). I argue that these clusterings of properties can be given various subtle (broadly "commonsense") explanations using a version of mereology that denies the classical axiom of "extensionality" (that is, denying that two distinct things must have distinct parts). I offer a challenge to the Quinean metaphysics: to show that these "non-extensional" explanations can be replaced by *better* explanations that use only classical, extensional mereology and set theory.

1. *Introduction*

In the twentieth century there was a sea-change in metaphysics: both universals and individuals were translated into things both rich and strange. Roughly speaking — universals turned into sets, and individuals turned into mere aggregates of their parts. A paradigm for this change can be found in Quine's *Word and Object*. Quine is ontologically committed to many sets, and to many aggregates. In either case, Quine posits many more of these things than we were formerly inclined to countenance in our everyday theories of what the world contains. So in one way his ontology was filled out with more things than are dreamt of in folk philosophy. Yet in another

way, Quine was niggardly in his ontology. His metaphysics was the resultant of two forces that pulled in different directions. One was a principle that proliferated entities, a kind of "creator", a Brahma-principle; another was a principle that eliminated entities, a kind of "destroyer", a Shiva-principle.

The first of these is a principle ensuring that whenever (or almost whenever) we have some things, then there is a *set* that has all and only these things as members; and also, there is always an *aggregate* that has all these things as parts (and no further parts except the parts of these parts, and aggregates of the parts of these parts). That is the proliferating principle. The second, the eliminativist or abolitionist, principle asserts that when we have some things, there can be *only one* set that has all and only these things as members, and *only one* aggregate that has all and only those parts that this aggregate has. This principle travels under the name "extensionalism". It requires that a distinction in identity *always* requires a difference in "extension" (set membership, or parts). It is useful to take sets and aggregates to be simply *defined* to be "extensional" things of which these two Brahma and Shiva principles hold. That is, it is useful to stipulate that it is true *by definition* that you need different members in order to make a different set, and that you need different parts to make a different aggregate. Although Quine attacks the notion that there are any theoretically significant "analytic" truths, he is aptly interpreted as endorsing these stipulative definitions of "sets" and "aggregates", and hence allowing — in this case — that it *is* simply *analytic* that distinct sets (or aggregates) need distinct members (parts).

These two pillars of Quine's metaphysics, *sets* and *aggregates*, support a metaphysical "desert landscape" in which nothing exists but (as one might say) just "atoms and the void" — a four-dimensional rather than a three-dimensional void, containing distinct "atoms" with at most one of these atoms at any one space-time location — along with both sets and aggregates of these atoms, and both sets and aggregates of the points and regions within this four-dimensional void. This desert landscape is very like a four-dimensional version of the metaphysics of Lucretius in *On the Nature of Things*. I endorse a Quinean stipulative definition of sets and aggregates. I warn that it is then an open question whether these "extensional" sets and aggregates, so defined, really exist: but for present purposes I endorse Quine's postulation that all these sets and aggregates do exist. My present purpose is to challenge his claim that *only* such "extensional" things exist. I will offer reasons for thinking that there may be "nonextensional" things *as well as* sets and aggregates.

These "nonextensional" things come in two kinds. One kind of "nonextensional" thing is a "universal" — either a property or a relation. I think there are properties, as well as sets: and that there can be two distinct properties that are "had by" all and only the members of just one set. But I will not argue for this claim here. What I will argue for is a parallel claim about the

individuals that *have* properties. I will argue that there can be two distinct individuals that have all the same parts. Admittedly, there cannot be two distinct "mere aggregates" that have all the same parts: but that is because of the essential nature of the things we are calling "mere aggregates", not because of the essential nature of the part-whole relation itself. I will argue that there can be things that happen to have all the same parts as some determinate mere aggregate, but that nevertheless have different properties from that mere aggregate. Think, for instance, of Michelangelo's statue of *David*, and compare it with the mere aggregate of atoms within it. There is no atom that is a part of the statue and yet not part of that mere aggregate, or *vice versa*. Nevertheless there are things that are true of the statue and not true of the mere aggregate of atoms, and *vice versa*. For instance, Michelangelo was deeply impressed by the thought that this very same aggregate of atoms had existed, buried in a quarry, for many long centuries before he chipped away the surrounding marble, thereby "creating" the statue.

The statue and the aggregate are closely related, but they are not "indiscernible". We might say that the statue *contains* all that marble (and nothing else), or that the aggregate of bits of marble *constitutes* the statue; and there may be various other relationships between these two things. Indeed, there may be further things that also stand in various, equally close relationships to the statue and the aggregate of bits of marble, without being numerically the same things as either the statue, or the aggregate of bits of marble, or one another. These various things may (I say) have different properties, without having to have different parts. Everything that is a part of the whole aggregate of bits of marble is also (I say) a part of the statue; and everything that is part of the statue is also (I say) a part of the aggregate of bits of marble. According to this theory, therefore, the mereological principle of extensionality is false.

This theory, be it noted, is distinct from some other theories that also distinguish the statue from the aggregate of bits of marble, but do so without questioning extensionality. According to those theories, the parts of the statue are things like the hand, the foot, the lip, the eye, the brow: and we should not include mere bits of marble as "parts" of the statue at all. According to those theories bits of marble may *constitute* the thumb, or whatever, which in turn is part of the statue: but those bits of marble are not themselves (strictly) "parts" of the statue. Such theories are worth exploring, but they are not the subject matter of this paper. This paper is exploring only those theories that allow that bits of marble *are* parts of the statue, and *are also* parts of the mere aggregate, but the statue and the mere aggregate are numerically distinct things even though everything that is part of one is also part of the other. I urge that this theory is also worth exploring, even though it contradicts the principle of extensionality. It is, I say, not self-evident that it is false.

Thus, I will support Quine's Brahma-principle, for both sets and aggregates; but I will suggest that his Shiva-principle needs to be restrained — both for Platonic properties that members of a set may "share in common", and for the various individual things that aggregates can "constitute". The result will be a flowering of the desert: in addition to all Quine's abstract sets, and all Quine's concrete aggregates, we should add further abstract things, "universals", which have sets as their extensions without *being* merely those extensions; and we should also add further concrete individuals that are "constituted" by aggregates without *being* mere aggregates. This requires a supplementation (but not a replacement) of both set theory and "classical extensional mereology". Set theory (particularly "ZF", Zermelo-Fraenkel set theory) is well known outside philosophy — in mathematics. "Classical extensional mereology", or "CEM" — a distinctive theory of aggregates, and of wholes and their parts — is less widely known.

In the foundations of mathematics, Quine worked very hard in the development of set theory (seeking new foundations, "NF", an alternative to ZF). In addition, Goodman and Quine together worked out a clear and persuasive articulation of "classical extensional mereology" (CEM), very similar to a theory described earlier by Leśniewski (which he had dubbed simply "mereology"). Articulation, however, is not yet an argument; and Goodman and Quine's theory of mereology was not supported by strong argumentation. The theory was so elegant, so closely parallel to the set theories familiar in mathematics, that merely stating CEM seemed to be persuasive enough. Many (like me, I confess) had only to hear and understand it, to buy it. Nevertheless, the way the theory was propounded — without supporting argumentation — does carry an unnerving suggestion that Quine, and others, had tacitly taken the axioms of CEM as "self-evident", *a priori*, necessary truths.

Here, for instance, is one of the places where Goodman introduces one of the key postulates of CEM (namely, the postulate I will be calling "Extensionality"):

> If the calculus of individuals is used along with the calculus of classes in a platonistic system, the identity of individuals may be defined in the usual Leibnizian way. But since this usual definition says, in effect, that a and b are identical if and only if they belong to exactly the same classes [*i.e.* if they have exactly the same properties], it is not open to us if we are to restrict ourselves to the language of individuals. However, a definition of "is identical with" can readily be provided within the calculus of individuals: a and b are identical if and only if they overlap exactly the same individuals

D2.044 $x = y = (z)(z \circ x \equiv z \circ y)$.

> The definition is to be accompanied, of course, by the usual rule permitting substitution of either side of a true identity statement for the other side in any context.
>
> (Goodman, 1951, Chapter 2, Section 4, p. 35. ["$(z \circ x)$", to be read as "z overlaps x", means that there is something that is a part of z and is also a part of x.])

Quine, too, asserts and assumes principles like this D2.044 (that is, principles of mereological Extensionality) in the same breezy way ("of course"!) — as if they were self-evident. This is more than just *stipulating* what he means by "aggregates" and "parts": he is also asserting that whenever we have some things then *there is* an aggregate (so defined) which has just those things as parts, and *there is nothing else* which has just those things as parts. This is unnerving — because Quine is also famous for the view that *nothing* is self-evident, or a priori — and for eschewing all claims of "necessity" or "possibility", or any other "modal" claims. Quine is rightly celebrated for the very general methodological principle — both for philosophy and for science — that all claims need to be supported by what might aptly be called "inference to the best explanation", and none can be taken as self-evident. I will be endorsing Quine's methodology, and using it against him, taking him to task for unQuinean theorizing in mereology.

In the case of set theory, Quine does sketch a supporting inference to the best explanation: to explain our experience we need physics; to do physics we need mathematics; the best mathematics is currently formulated in set theory; there seem to be no real rivals on the horizon; therefore we have good reason to believe in set theory. In all consistency, Quine should have argued in broadly this manner not only for set theory but also for CEM. He should have identified things that can be explained by CEM; he should have compared these explanations with possible rival alternative explanations; and he should have given reasons for thinking CEM provides a "better" explanation than any rivals. He does not do this.

Indeed, CEM is so similar to set theory that it is a little hard to see what explanatory power could possibly flow from CEM, which could not be extracted from set theory alone. Consider the theory that nothing has any "proper parts" (that is, any parts other than, trivially, itself): the theory that all that exist are mereological atoms. (This would be like a Leibnizian monadology.) Wherever Quine says there is an aggregate with many parts, we could say instead that there is only the set that has all those alleged "parts" as members. What could be the explanatory advantage to positing the aggregate *as well as* the set? Conversely, Goodman identified an explanatory advantage

to adopting mereology *instead* of set theory. Sometimes where set theory posits several distinct sets, mereology posits just one aggregate. For instance, in set theory the two sets $\{a, \{a, b\}\}$ and $\{b, \{a, b\}\}$ are distinct individuals, but in mereology there will be just one aggregate $(a+(a+b)) = (b+(a+b))$. Hence mereology has a virtue of *economy*, over set theory. This is a reason for affirming mereology rather than set theory, if both will give equally good explanations of all the things that need to be explained. It is not, however, a good reason that Quine can use for affirming mereology *as well as* set theory.

A charitable reading would take Quine to have advanced CEM with the expectation that it will be simply *obvious* that CEM provides neat explanations of many things — clearer than muddled commonsense explanations — and that CEM is obviously at least compatible with current science — and faced by no significant rivals that could plausibly be taken to offer any better explanations — or, at least, no better explanations of anything that really needs to be explained. But though these things may have seemed obvious to Quine, they deserve a closer look. In particular, Quine might have been taxed with some commonsense modal claims that are difficult to explain within CEM. A memorable example is furnished by many discussions of the difference between a statue, "Goliath", and "Lumpl", the lump of clay out of which the statue was made. Lumpl has *potentialities* that Goliath lacks. So the statue is not *merely* a lump of clay. Or so it might seem to common sense.

Peter Simons (1987), for instance, does a very good job of articulating arguments of this kind against CEM; and many others have done likewise, both before and after Simons. This line of attack against Quine assumes that certain commonsense modal claims should be counted as among the things that "need" to be explained. However, in weighing up which are the "best" explanations, Quine did not place any significant weight on any need to conserve commonsense assumptions, especially not commonsense *modal* assumptions. Quine assumes that the best theories will need to endorse the best current sciences, like physics. But when Simons asks for a best theory to explain certain commonsense modal claims about objects, Quine is unmoved.

I think Simons and others are right, and Quine wrong, about this: but in arguing against Quine I will take another tack. Instead of assuming that commonsense assumptions "need to be explained", I will argue instead that there is something very basic that does need explaining: namely, the way that properties travel around in "clumps". I will then argue that there are possible mereological alternatives to CEM, which would offer some promising ways of explaining those "clumping" facts that do need explaining. (As it happens, these alternatives to CEM do borrow from common sense: but I do not cite this as part of the argument against Quine.) A Quinean might then argue that a combination of extensionalist set theory and CEM mereology could provide *an alternative* explanation of all those same "clumpings". This, I

do not contest. It may be possible to articulate a theory that explains all the same "clumpings", using just extensional set theory and CEM. Yet this is not enough to show that set theory and CEM furnish "the whole truth". A Quinean "inference to the best explanation" would need to show that this theory is *better* than the ones furnished by a rival mereology. I then maintain that it is far from obvious that a Quinean theory, using just CEM and set theory, could provide a "better" explanation for all "clumping" facts that need explaining. Hence a rival metaphysics, a lush jungle, is currently still a viable alternative to Quine's desert landscape.

2. *Plenitude and Extensionality*

There is a deep isomorphism between the theory of universals, and the theory of individuals and their parts. It is instructive to look first at the historical trajectory of the theory of universals, and the way universals turned (as it were) into sets. Roughly, I will suggest that there are two foundational principles Quine affirms, and he affirms them both in set theory and in mereology. I will call these: the Principle of Plenitude, and the Principle of Extensionality.

Plenitude:
In brief: in the theory of universals, before it turned into set theory, Plenitude would be the thesis that whenever we have some things, there will always be something that is shared in common by all and only these things. (After the theory of universals has turned into set theory, Plenitude becomes something *close* to the thesis that whenever we have some things, there is a set containing all these things and only these things.) In mereology, Plenitude is the counterpart thesis that whenever we have some things, there is at least one thing that has all these things as parts. Indeed, there may be many things — "bigger and bigger things" — each of which contains all these things as parts. But CEM adds the assumption that there is in fact just one unique "minimal" thing that has all these things as parts. The *aggregate* of all these things is what you get by aggregating *just* these things, and no more. This will be something that has all these things as parts — and also has, as parts, all the *parts* of those parts — and also has, as parts, all the *aggregates* of the parts of those parts — but has no *further* parts beyond these.

Extensionality:
In the theory of universals, after it has turned into set theory, Extensionality is the thesis that for any two sets, there will be at least one thing that is a member of one of those sets and is not a member of the other one. In mereology, an Extensionality principle will be the thesis that for any two

individuals, there will be at least one thing that is a part of one of those things and is not a part of the other one.

Pluralism:
The denial of the Extensionality Principle, I will call the *Principle of Pluralism*. The doctrine that there are universals (*other than* sets) is often called "metaphysical realism", or "realism about universals": I am offering the additional label, "Pluralism", for this doctrine. I will argue for Pluralism in mereology, using the same kinds of arguments that Lewis used to argue for this corresponding principle of Pluralism in the theory of universals.

There will be many different versions of Pluralism. That is, there are many possible theories that all agree in rejecting Extensionality, but disagree about various other putative axioms of mereology. The devil is in the details, and I will not venture far into this territory here. It may help, however, to sketch one simple illustration of how a Pluralist theory might be offered as a supplementation of an Extensionalist mereological theory.

I suggest that we might think of the mathematical theory of "combinations" as a model for one very simple Extensionalist mereological theory, and the theory of "permutations" as a model for a corresponding Pluralist theory. Imagine a "granular" space with just three points, a, b, c, each adjacent to both the others. How many *regions* are there in this space? Seven (2 cubed minus 1): a, b, c, ab, ac, bc, abc. Define the part-whole relation in the obvious way. Compare this with the theory of how many "combinations *and permutations*" we can make using these three atomic elements. Suppose you are selecting from these three, and you choose a and then you stop; or you choose a and then you choose b and then you stop; or you choose b and then you choose a and then you stop; our you choose a then b then c and then you (have to) stop. We can develop a theory about how many things you can generate in this way, under the hypothesis that the thing we obtain by choosing "a then b" is a numerically distinct thing from the thing we obtain by choosing "b then a". The idea is not just that the pair of a and b could have one or another of two relational *properties* (the property of having been formed from a first, then adding b, *versus* that of being formed from b first, then adding a). The hypothesis under investigation is not that there are just two distinct properties of a single thing, but that there are two distinct *things*. You could think of "a then b" as what mathematicians might call the *directed* line segment ab, which can be distinguished from the *directed* line segment ba.

Standard semantics models the theory of "combinations and permutations" as a theory of *sequences*, where different sequences are modelled by different sets. We might for instance represent "a then b" as the set $\{a, \{a, b\}\}$, and "b then a" as the distinct set $\{b, \{a, b\}\}$. We can transform a standard model of this kind into a semantic model for a Pluralist theory. This Pluralist

theory will posit that there are two distinct things, "a then b", and "b then a" — which differ in some of their properties even though they do not differ in any of their parts. Take this standard model, and define a 1-1 function, which maps the set $\{a, \{a, b\}\}$ onto one concrete individual, call it AB, and $\{b, \{a, b\}\}$ onto a distinct concrete individual, call it BA. Do the same for other relevant set-theoretical representations of the possible combinations and permutations of the three points a, b, c.

We can then give a classical set-theoretical interpretation for a Pluralist theory about these posited concrete individuals AB, BA, and so on. Within this theory there will be a symbol that represents the relation "is a part of": semantically map this symbol onto a set of ordered pairs — in the standard way in which we interpret two-place predicates in formal modal theory. Define this set of ordered pairs in such a way that a will count as "a part of" AB; and that a will also count as "a part of" BA; and also that b will count as "a part of" AB; and that b will also count as "a part of" BA; and that nothing else will count as "a part of" either AB or BA (apart from AB and BA themselves). Do the same for other relevant "*directed* line segments" in our toy model of a three-point, granular space. Then we will have a demonstrably consistent theory according to which there are two numerically distinct individuals AB and BA, which do not differ in any of their parts. Likewise, we may posit the existence of six distinct, concrete "*directed* angles": ABC, ACB, and so on. Again, we may posit that each has the same parts, a, b, and c, and that each (as you might say) *contains* all the other directed angles, and the same points, without any of these directed angles being identical to, that is, indiscernible from, any of the others, or being identical to the mere aggregate of the three points a, b, and c.

Having reconstrued the part-whole relation, in this Pluralist theory, we will need to reconsider which of the axioms of CEM can still be maintained as true in this broader application of the part-whole relation. Some axioms may be retained (transitivity for instance: that "a part of a part is a part"). But others might need to be renounced. For instance, there is an axiom that Simons (1987, p. 362) calls Supplementation, and this is one of the small core that he proposes as capturing the essential properties of *any* part-whole relation, as applied to *any* subject matter whatever. This axiom asserts that when one thing a contains another, distinct, thing b as a part, then it is possible to "subtract" b from a, and when you do you must always be left with a "remainder", which will be something that is another part of the whole, a, and that does not in any way overlap with the subtracted part b. This axiom has to be reconsidered, in the light of the above illustration concerning "directed angles" and so on. Varzi (2009) argues that (in my terminology) Plenitude entails Extensionalism, provided you assume a few other basic principles, including Supplementation. Hence, if I am to endorse both Plenitude and Pluralism, I will have to deny Supplementation. I am not reluctant to do so.

Think of the statue and the marble: the statue contains all the bits of marble, without being identical to the aggregate of all the bits of marble: but this does not mean that if you subtract all the marble you will be left with some "remainder", something which is a part of the statue but not part of that aggregate of bits of marble. No, if you subtract all the bits of marble then there will be *no* part of the statue that is left as a remainder. If you deny Extensionality, then you should deny Supplementation too. There is much work to be done in exploring the logics of what we might call "weak mereologies", as rivals to CEM.

Quineans will argue, plausibly, that we do not *need* to posit the existence of any such "directed line segments" or "directed angles", as new individuals — in addition to the Quinean, extensional sets and aggregates involving the three things a, b, and c. We can reconstrue talk of such purported things not as literally referring to concrete things that transgress CEM, but rather, as merely different *ways* of talking about the more tractable, extensional, sets and aggregates of CEM. Yet the little exercise sketched above shows that, even if we do not *need* to posit nonextensional things like "directed lines" and "directed angles", it is not *logically inconsistent* to frame such a theory. Quineans might, indeed, plausibly argue that we should not accept any such theory — on such grounds as "Ockham's razor". I will face that argument shortly. But Quineans cannot argue that we should reject any such theory simply on the *a priori* grounds that any such theory would be logically inconsistent — or on the grounds that it is *analytically* false, or that for yet some other reason it is *self-evidently* false. It is possible to articulate a "relative consistency proof", along the lines I have sketched, which shows that there are Pluralist theories that are at least *internally* consistent, if CEM and ZF are.

3. *Quine was half right*

I think Quine is basically right about Plenitude, both in the theory of universals and in mereology. But I will not argue that here. I will focus on Extensionality. I will look for reasons for thinking that Extensionality might be false, both in the theory of universals and in mereology. In the theory of universals, there are some — inconclusive, yet still relatively weighty — reasons to think that Extensionality is mistaken. The kinds of reasons I have in mind were sketched vividly by David Lewis, in a paper called "New work for a theory of universals" (1983). I will argue that there is a deep isomorphism between the theory of universals, on the one hand, and mereology, on the other. For this reason, the kinds of reasons that Lewis raised for doubting Extensionality in the theory of universals will carry over into similar reasons for doubting the corresponding Extensionality principle in mereology.

There is a risk in placing too much weight on "simplicity", when developing axiomatic theories that are supposed also to do heavy-duty explanatory work in science (or common sense). As Simons says (1987; p. 364): "It is tempting to be led by the attraction of internal properties of the formalism either into taking the world to be tamer than it is, or into a relativistic, pragmatic attitude to ontology which can be seen at its most significant in Quine." Simons (like Goodman before) suspects that Quine's aesthetic attraction to purely formal features of set theory leads him astray — drawing him into a set theory that offends Ockham by "multiplying entities" to yield a ridiculously large number of "pure sets", which do no real work in science. (Indeed, Simons also thinks that Quine's mereology also yields a large number of "mere aggregates", which do no real work in science.) Furthermore, Simons (unlike Goodman) suspects that Quine's aesthetic attraction to purely formal features of mereology leads him astray — drawing him into a mereological theory that *fails* to "multiply entities", even when there is an explanatory necessity to do so. Simons aims to get Ockham's balance right: and to multiply entities where and only where there is an explanatory necessity to do so. This methodological aim of Simons, we might call "selective realism": and it is aligned with my overall argument in this paper. Hence I sympathize with Simons, in being wary about Quine's attraction to the sheer "simplicity", the formal elegance, of CEM, as contrasted with its rivals.

Nevertheless, I take it that Quine is right to shift some burden of justification onto rival theories that are less tidy than CEM. We need to find ways in which the world is, indeed, sufficiently "untamed" to warrant a less formally elegant theory than the elegant CEM that we might otherwise have been able to enjoy. Thus, I take a "burden of explanation" as a legitimate one to place on theories that set themselves up as rivals to Quine's. If we are to accept one of these rival theories, then we will, at the very least, need to find some salient things that can be explained by these rival theories.

4. *New work for a theory of universals*

In his influential paper "New work for a theory of universals" (1983), David Lewis set out in search of things that, arguably, we do need to explain, and for which you could offer at least a putative explanation if you were to adopt a theory of universals of roughly the kind articulated by David Armstrong. Lewis does not claim that an Armstrongian theory will provide the "best" explanation for these things. He suggests, on the contrary, that perhaps an equally good explanation could be provided by a theory of "tropes", like that advanced by Donald Williams and Keith Campbell and others. And there may be further alternatives that should be considered, before we venture the last step in an "inference to the best explanation". Nevertheless, Lewis

did take the first steps in mounting an argument of this kind, by identifying things that it would be good for us to try to explain, and that we might at least try to explain using a theory of universals, as distinct from sets.

What kind of "explanation" was Lewis seeking, when he asked what "new work" might be done by a theory of universals? He was not seeking for what might be called "causal" explanations. That is, he was not seeking an explanation of a kind that Aristotle might have classified under the label "efficient cause" (or "final cause"). Lewis did not seek to find ways in which Armstrong's universals could, as it were, "make things happen" (nor did he seek the "goals" they might help us achieve). Rather, what Lewis sought were explanations of a kind that Aristotle might have classified under the label of "material" or "formal" causes. That is, he was seeking accounts of what *constitutes* something we need to deal with in the world. To ask about "material" or "formal" causes is to ask something of roughly the same kind as the question, "What *is* electricity?" — as contrasted with the question, "What are the causes and effects of electricity?" Lewis asked questions like, for instance, "What *is it* for one thing to be an exact duplicate of another?" — as contrasted with a question like, say, "How can we make an exact duplicate of something?" Thus, to give another illustration, Lewis was not seeking to find ways in which Armstrong's universals could "make things happen" — but rather, to find ways in which Armstrong's universals might purport to explain *what it is* for one thing to make another thing happen.

Lewis's strategy, in sketching an argument for universals, begins with things that *he thinks* need to be given an "explanation". Many, like Quine, would be unimpressed by the things Lewis asks us to try to explain: they would deny that these things *need* to be explained in the first place. They might also turn their noses up at the kinds of "explanations" that Lewis asks us to try to find. Nevertheless, it is worth keeping in mind the broad strategy that Lewis is employing here, in suggesting a way in which Armstrong might mount an argument in support of the existence of universals. This would, if it worked, furnish an argument for a theory of universals endorsing Plenitude: that is, permitting two universals to be distinct even if everything that *has* one of them also *has* the other. We should take this broad argument-schema, in the theory of universals, as a prototype for a possible argument for Pluralism in mereology.

5. *New work for a theory of individuals*

With this background as a guide, I propose to seek things that need to be explained, and for which we can at least purport to offer illuminating explanations if we adopt a principle of pluralism, rather than a principle of extensionality, within mereology. Here is a sketch of something that is pervasive,

and that needs to be explained: properties generally travel around together in what we might call flocks, herds, clumps, clutches, bundles, bunches ... or whatever. We find a bunch of properties in one place at one time: and we can sometimes confidently predict that there will consequently be a similar bunch of properties at another place at another time.

These bunchings of properties are open to several distinct metaphysical construals. For instance, on one theory there will be a single thing that "has" all the properties in a given bunch. On another theory, those properties will be attached to several different things. But often we can know that there is something that needs to be explained, just by knowing that there is some thing *or* things that have the properties in a given bunch. We can track bunches of properties, and ask for an explanation for the way these bunches behave: and different ways of attaching these properties to "things" will furnish different possible explanations. For instance, if a clump of properties including mass, size and shape is present "in mid-air", then sometimes we can predict something about the compresence of three similar properties of mass, size and shape, a few seconds later, a little closer to the ground — perhaps not *exactly* the same mass, size and shape, but at least *similar* properties of mass, size and shape. In commonsense theories (and in science, for that matter) we often explain *why* a bunch of properties like this travels down towards the ground, by saying that there is a *thing* that *has* all these properties, and that this thing is falling towards the ground — taking all its properties with it.

Alternative explanations are possible. For instance, it might be postulated that there is a sequence of different things, existing at different times, and that the properties had by any one of these things are also had by the next in the sequence. But in many cases the commonsense theory is at least worth considering: that there is one thing that has all these properties at the earlier time, and it falls towards the ground, taking most of its properties with it. Our commonsense theories provide for a rich tapestry of different possible explanations for the various different ways in which we find properties travelling around in bunches. What we do is to posit the existence of some *things*, which *have* these properties. We also posit a variety of different relationships that may hold between these things and their properties. The ones that cling tightest are the "essential" properties; others are not absolutely essential, but very hard to shake off once you have acquired them; others might breezily come and go; and so on. In addition, commonsense theories also posit ways in which sometimes *things* might clump together, and travel around in each other's company, carrying their properties with them. Such clumpings of individuals thereby provide many distinct, alternative, indirect explanations of clumpings of properties.

Thus, for instance, one bunch of properties might have a propensity to travel around together because there is one individual that has them all,

whereas another bunch might travel around together because there are two individuals, one with some of those properties and the other with the others and there may be some reason why these two individuals happen to be travelling around together. The two distinct individuals might independently have similar interests, which happen to lead them to the same places at the same times, as for instance if they both are following the same concert tour by Bob Dylan. Alternatively, the two individuals might be married to one another. Or they might be handcuffed together. Or they might be Siamese twins: sharing an organ. Or, shifting attention from individual people to material objects, it may be that two individual objects travel around together because one is a *part* of the other. Or, they might travel together because one *constitutes* the other. In commonsense theories, there are many ways in which individuals might travel around together, carrying their properties with them. Hence there are many different ways of explaining clumpings of properties.

Some bunches of properties have a tendency to persist fairly unchanged, like the bundle of intrinsic properties of a rock, for instance. In contrast, some aggregations of particles, like clouds, are not very cohesive. By contrast, think of a plant: it is different both from a rock and from a cloud. A plant does not keep the same shape exactly — both because it grows and because its leaves may wave about in the breeze. But, at least in the short term, it does keep *similar* shapes as time passes, and it does so (as we might say) fairly robustly. And some of its trajectories of change may be among its essential properties. Likewise for species that predictably go through *phases* during their lifetime: caterpillars becoming butterflies, and so on.

Our commonsense theories exploit the notion that properties form bunches *because* they attach themselves to things, and because they attach themselves to those things under different *modes* of attachment, and because those things then sometimes clump together in a variety of different ways. This illustrates some of the explanatory potential of a theory that postulates the existence of *things*, which *have* properties, along with a distinction between the essential and the accidental properties of those things. Roughly speaking: a theory of this kind can give a rich tapestry of subtly different explanations for numerous, subtly different ways in which properties can travel around in bunches.

6. *Individuals enough to entail Pluralism?*

Grant, then, for the sake of further investigation, that there may be some explanatory potential in a theory that distinguishes between the essential and the accidental properties of an individual. It is then possible, within such a theory, for there to be two individuals — which are distinct individuals, with distinct properties — even though there is nothing that is a part of one and

not a part of the other. That is, such a theory makes it possible, indeed likely, that there will be failures of the mereological principle of Extensionalism. It is possible, for instance, for you to have the same parts as your body, and yet for you to have some properties that your body does not have. It is possible for there to be an aggregation of planks, and for there to be a ship, and for there to be no plank in the aggregate that is not part of the ship, and no plank in the ship that is not part of that aggregate of planks — and yet for the ship to have properties that the aggregation of planks does not have.

The reasoning here is closely related to a widely-recognized line of argumentation against CEM. Here, for instance, is Simons (1987, pp. 1–2):

> An object with different parts at different times cannot be identical with the sum of its parts at any time, for then it would be different from itself. The second problem is that some objects (again, like human beings) might have had some parts other than those they in fact have, and yet still have been the same objects. In other words, they are not modally *rigid* in their parts.

Here Simons appeals to commonsense explanatory theories, which posit things that endure through time, and that could have been other than the ways they are. He argues that these explanatory theories flout Extensionality. Quine defends Extensionality by appeal to his metaphysics of spacetime, and "temporal parts"; but Simons thinks this defence is unsuccessful:

> ... A second and more popular solution to the flux problem is to propose replacing the things (continuants) of our usual ontology by processes, which have temporal parts. I argue that the difficulties involved in such a revision have been greatly underestimated, and that in any case the move fails to save mereological extensionality because such four-dimensional objects fall prey to the modal argument.

Quine would resist "the modal argument" by refusing to countenance any modal truths in the canonical theories of developed sciences. So the argument between Simons and Quine threatens to shift into a prior disagreement about how seriously we should take commonsense modal claims. But there is another way of construing the kind of argument Simons is advancing, one that gets behind this dispute over common sense. Some mereological extensionalists, other than Quine, might accept the need to explain the modal facts that Simons cites: but they might explore ways of doing this without abandoning mereological extensionalism. They might say that the division of a thing into "temporal parts", as mentioned by Simons, was a step in the

right direction: and they might seek ways of extending these techniques to cover the modal case. Maybe they are right: maybe an extensionalist mereology could always, in principle, be constructed to explain away any of the problems of the kind Simons has raised.

Yet a Quinean "inference to the best explanation" needs to do more than just show that CEM can mount *an* alternative explanation of things that need to be explained. It needs to show that this explanation mounted by CEM is *the best* explanation. It needs to show that this extensionalist explanation is *better* than any alternative. Here is a way of reconstruing the argument Simons has mounted. He shows that a theory that flouts Extensionality can be coherently mounted, and that it can at least make a fist of explaining certain important features of our experience. Quine's job, then, is not just to find *some* alternative explanation that does respect Extensionality, but also to show that this alternative explanation is *better* than a Pluralist (and in some ways more commonsensical) one. I do not claim to show that Quine could not do this: only that it has not yet been done.

I conclude that there is good reason for further investigation of a Pluralist rival to the Quinean Extensionalist metaphysics — a rival which acknowledges the existence of all the aggregates (and sets) that Quine posits, but which also allows that sometimes these aggregates may also constitute individuals, like power poles and policemen, which are something more than mere aggregates of the parts they happen to possess at any one given time.

School of Philosophical, Historical and International Studies
Monash University
Clayton
Victoria 3800
Australia
E-mail: John.Bigelow@arts.monash.edu.au

REFERENCES

Baker, Lynne Rudder, "Why constitution is not identity", *Journal of Philosophy* 94 (1997), pp. 599–621.

Baker, Lynne Rudder, *Persons and Bodies*, Cambridge University Press, Cambridge UK, 2000.

Bigelow, John and Robert Pargetter, "Real work for aggregates", *dialectica* 60 (2006), pp. 485–503.

Boyd, Richard, "Homeostasis: species, and higher taxa", pp. 141–185 in *Species*: *New Interdisciplinary Essays*, ed. Robert A. Wilson, MIT Press, Cambridge MA and London UK, 1999.

Chisholm, R.M., *Person and Object*: *A metaphysical study*, Open Court, La Salle, 1976.
Doepke, F.C., "Spatially coinciding objects", *Ratio* 24 (1982), pp. 45–60.
Fine, Kit, "Compounds and aggregates", *Nous* 28 (1994), pp. 137–158.
Goodman, Nelson, *The Structure of Appearance*, Harvard University Press, Cambridge MA, 1951.
Goodman, Nelson and W.V. Quine, "Steps towards a constructive nominalism", *Journal of Symbolic Logic* 12 (1947), pp. 105–122.
Harte, Verity, *Plato on Parts and Wholes*: *The metaphysics of structure*, Clarendon Press, Oxford UK, 2002.
Haslanger, Sally, "Persistence, change, and explanation", *Philosophical Studies* 56 (1989), pp. 1–28.
Hovda, P., "What is classical mereology?", *Journal of Philosophical Logic* 38 (2009), pp. 55–82.
Johnston, Mark, "Constitution is not identity", *Mind* 101 (1992), pp. 89–105.
Leśniewski, S., *Collected Works*, 2 vols., ed. S.J. Surma, J.T. Srzednicki, D.I. Barnett and V.F. Rickey, Kluwer, Dordrecht-Holland, 1992.
Leonard, Henry S. and Nelson Goodman, "The calculus of individuals and its uses", *Journal of Symbolic Logic* 5 (1940), pp. 45–55.
Lewis, D.K., "New work for a theory of universals", *The Australasian Journal of Philosophy* 61 (1983), pp. 343–377.
Lewis, D.K., *Parts of Classes*, Blackwell, Oxford UK, 1991.
Lucretius, *On the Nature of Things*, transl. H.A.J. Munro, Washington Square Press, New York NY, 1965.
Quine, W.V., *Word and Object*, MIT Press, Cambridge MA, 1960.
Rescher, N., "Axioms for the part relation", *Philosophical Studies* (1955), pp. 8–11.
Robinson, Denis, "Matter, motion and Humean supervenience", *Australasian Journal of Philosophy* 67 (1989), pp. 394–409.
Shorter, J.M., "On coinciding in space and time", *Philosophy* 52 (1977), pp. 399–408.
Simons, Peter M., *Parts*: *A study in ontology*, Clarendon, Oxford UK, 1987.
Tarski, A., An exposition of a simplified version of Leśniewski's calculus, in an appendix to J.H. Woodger's *Axiomatic Method in Biology*, Cambridge University Press, Cambridge UK, 1937.
Unger, Peter, "There are no ordinary things", *Synthese* 41 (1979), pp. 117–154.
Van Inwagen, P., "The doctrine of arbitrary undetached parts", *Pacific Philosophical Quarterly* 62 (1981), pp. 123–137.
Van Inwagen, P., *Material Beings*, Cornell University Press, Ithaca NY, 1990.
Varzi, Achille C., "The extensionality of parthood and composition", *Philosophical Quarterly* 58 (2008), pp. 108–133.

Varzi, Achille C., "Universalism entails extensionalism", *Analysis* 69 (2009), pp. 599–604.
Wiggins, D., *Sameness and Substance*, Blackwell, Oxford UK, 1980.