

Mereological Commitments

Achille C. Varzi

Department of Philosophy, Columbia University, New York

(Published in *Dialectica* 54 (2000), 283–305)

Abstract. We tend to talk about (refer to, quantify over) parts in the same way in which we talk about whole objects. Yet a part is not something to be included in an inventory of the world over and above the whole to which it belongs, and a whole is not something to be included in an inventory over and above its own parts. This paper is an attempt to clarify a way of dealing with this tension which may be labeled the Minimalist View: an element in the field of a part-whole relation is to be included in an inventory of the world if, and only if, it does not overlap any other element that is itself included in the inventory. As it turns out, a clarification of this view involves both a defense of mereological extensionality and an account of the topological distinction between detached and undetached parts (and the parallel opposition between scattered and connected wholes).

1. Introduction

My finger is touching the top of the table. How many things am I touching? We'd be likely to count just the table and answer: One. But if we are given a list including the table, its top, its four legs, and other things, and if somebody asks "How many things on this list are you touching?", we'd be likely to count the table as well as the top and answer: Two.

I take this ambiguity to reflect a general concern about the ontological status of proper parts, a concern that lies in the background—though rarely in the foreground—of much part-whole theorizing. Typically one treats parts as objects of quantification on a par with the wholes to which they belong. This is so in formal treatments of the parthood relation, such as Leśniewski's *Mereology* or Leonard and Goodman's *Calculus of Individuals*. And it is so also in much ordinary speech. We often talk about parts with the same easiness with which we talk about whole objects; we name parts, describe them, compare them with one another. (The top of the table is not as scratched as its legs. Tibbles' tail is longer than Pluto's.) However, this way of speaking goes hand in hand with the thought that an object's parts are things that do not quite have a life of their own—things that do not count except as parts of the whole to which

they belong. This is why we would only count the table in the first place. I'm touching the top *of* the table, so it is the table that I am touching. And if we had to draw up an inventory of the world—a catalogue of all there is—we'd be likely to include the table and not its parts.

This tension between countenancing and counting is, of course, particularly striking when we think of parts that are not physically separated from the rest of their wholes, such as the top of a table or the tail of a cat. Such parts do not have a complete outer boundary, so they do not have the thingy character that we expect from ordinary objects. By contrast, there seems to be nothing peculiar about the ontological status of those parts that do have a complete boundary, parts that are fully separated from the rest of the wholes to which they belong. Consider the scattered whole consisting of Tibbles and the table: their mereological sum, or fusion. Tibbles and the table are parts of this sum—they are proper parts. But that is no reason to question their individuality.

This also illustrates a dual worry concerning the ontological status of wholes, or mereological complexes broadly understood. If we do indeed include Tibbles and the table in our inventory of the world (and not their proper parts), shall we also include their mereological sum? This is not the question of whether the sum should be countenanced at all. We may agree that any collection of objects, however disparate and gerrymandered, forms a legitimate whole and yet ask: Shall we list this whole in an inventory of the world that already includes its constituent parts? Again, the tension is between a tendency to treat such things as objects of reference and quantification, on the one hand, and their being nothing over and above their proper parts, on the other. If Tibbles and the table are already in the inventory, adding their sum would be redundant. And as the redundancy is especially striking in the case of *undetached* parts, it is striking when it comes to *disconnected* wholes.

2. The Minimalist View

I am not, of course, suggesting that there is only one proper way of drawing up an “inventory of the world”, nor that the best way of drawing up an inventory is by listing all and only connected wholes. We may want to count a bikini (a disconnected aggregate) as *one* item, and we may want to count a bunch of five bananas as *five* items even though each one is undetached from the rest. We know since Frege that counting is no simple business, and an inventory of the

world—in the intuitive sense in which I am using the phrase—is closely related to a count policy. We cannot just ask—How many things? We must count things of a sort—How many bunches? How many bananas?¹ So we may think of an inventory as the result of sorting out the items in our domain of discourse, which is often a matter of context. The cashier will count five bananas; we may count them as one item when it comes to sorting out the things to be carried upstairs. There are many ways of drawing up an inventory. The question I am interested in is: How does mereology enter the picture? How does discourse about parts and wholes constrain our freedom to sort things out?

David Lewis sees this concern as one of ontological commitment:

Given a prior commitment to cats, say, a commitment to cat-fusions is not a *further* commitment. The fusion is nothing over and above the cats that compose it. It just *is* them. They just *are* it. Take them together or take them separately, the cats are the same portion of Reality either way. [1991: 81]

Thus, the ‘are’ of mereological composition—the many-one relation of the parts to a whole—is for Lewis a sort of plural form of the ‘is’ of identity. This view is also defended by Donald Baxter (among others), who actually holds that mereological composition is more than analogous to ordinary identity. It *is* identity:

The whole [...] is just the parts counted loosely. It is strictly a multitude and loosely a single thing [...] The whole is just the n parts collectively on the strict count, or is a single thing on the loose count, and in neither count are there $n+1$ things. [1988: 580f]

Now this view offers a simple and appealing way of resolving the tension alluded to above. Mereology distinguishes a whole from its parts. But the whole and the parts *encompass the same amount of reality* and should not, therefore, be listed separately in an inventory of the world. More generally, we should not include entities that overlap, i.e., share common parts. If we include the table we should not include its top and legs. If we include its top and legs, we ought to disregard the whole table *as well as* every other table part. For instance, we ought to disregard the right half of the table, consisting of the two right legs and the right half of the top.

¹ See Frege [1884: §§ 46ff]. For some classic discussion see, e.g., Dummett [1973, Ch. 16], Geach [1980: §§ 31ff], Wiggins [1980], and Lowe [1989].

Call this the *Minimalist View*. The Minimalist View says nothing specific about mereology, about what entities are part of what. But, given a mereological theory and a corresponding domain of quantification, the view tells us how to weigh our ontological commitments:

- (M) An inventory of the world is to include an entity x if and only if x does not overlap any other entity y that is itself included in that inventory.

Thus, a good inventory must be complete: everything in the domain of quantification must show up somewhere.² But a good inventory must also avoid redundancies: nothing should show up more than once.

This is of course not a definition. Rather (M) is a postulate on what it takes to be included in a good inventory of the world. On the Minimalist View, it does not matter what things we actually include, as long as the completeness and non-redundancy conditions in (M) are both satisfied.³ Moreover, in saying that the variables range over a domain that is fixed by the underlying mereological theory, I am formulating (M) in a way that is neutral with respect to issues of metaphysical realism. On the Minimalist View it does not matter whether the different domains that we can get by employing different mereological theories represent different descriptions of the same world, or different worlds altogether.⁴ The point is that once we have got the pieces, we may start drawing up an inventory. And a good inventory—one that reflects our ontological commitments—is not simply a list of all the pieces that we have got, a list of all that can enter our parthood relation. On the Minimalist View, a good inventory is more selective: it must meet the constraint in (M).

To put it differently, the Minimalist View draws a distinction between two senses in which a thing can be object of reference or quantification—two

² I am assuming here that the underlying mereology satisfies the remainder principle, so that if x properly overlaps y , then x has two parts, one included in y , and one disjoint from y .

³ If we think of the world as the mereological fusion of everything in it, then this amounts to the requirement that any inventory be a list of things of which the world is *strictly made up*, in the sense of Chisholm [1973: 587], or of which the world is *composed*, in the sense of van Inwagen [1987: 22]. A first formulation of (M) is presented and briefly discussed in Casati and Varzi [1999b: 111ff].

⁴ See Putnam [1987: 16ff].

notions of individual existence. In one sense, those items exist that are included in the domain of quantification of our part-whole theory, whatever it is (call this the *Quinean* notion of existence⁵). Obviously, different part-whole theories may have different domains, so the choice of one theory rather than another makes a difference with respect to this notion of existence. For instance, a standard Leśniewskian mereology will countenance the mereological sum $x+y$ whenever it countenances x and y , whereas a mereology deprived of the sum axiom may just countenance x and y . On the other hand, there is a sense in which just those items exist that are listed in the relevant inventory of the world, depending on how this is drawn up. These items will all be included among those things that enjoy Quinean existence, since they will have to be recognized as objects of reference and quantification by the part-whole theory; but not everything that exists in the Quinean sense must exist in this restricted sense (the *selective* notion of existence). It may actually be the case that different inventories are drawn up on the basis of one and the same mereological theory. One mereologist may go for a fine-grained inventory including x and y but not $x+y$; another mereologist may go for a coarser inventory including $x+y$ but not x or y . It may also be that the same inventory is grounded on different part-whole theories. (The mereologist who goes for the fine-grained inventory may end up with the same inventory as the alternative mereologist who does not countenance mereological sums: both would only list x and y .) Be it as it may, the Minimalist View says that the Quinean notion of existence sets the background for the selective notion, but does not exhaust it; the rest must be done in compliance with (M).

So this is how the Minimalist View takes the fundamental tension of mereology to be explained. We quantify over everything, since the meaning of ‘everything’ is set by the domain of the quantifiers; yet counting is selective. And we may set different standards for counting, but we must avoid omissions and repetitions. My aim in the following is to test and attempt a more complete account of this explanation. I shall especially focus on three questions, all of which seem to me crucial for a proper understanding of the Minimalist View. The first concerns the assumption—implicit in Lewis’s and Baxter’s remarks as well as in my formulation of (M)—that, when it comes to counting things,

⁵ Quine [1939].

the alternative is really between the parts and *the* whole. This is essentially the assumption that mereology is *extensional*—that there is only one whole for any given number of parts (i.e., equivalently, that two distinct wholes may not be composed of exactly the same parts). I shall address this question and some of its ramifications in Sections 3 and 4. The second question is addressed in Section 5 and concerns the distinction between connected and disconnected entities, and the related notion of a maximal, one-piece entity. This notion—I shall argue—plays some role in the proper account of certain puzzles that arise in relation to extensionality and is therefore needed for a proper understanding of (M). Moreover, a clarification of what it means for something to be maximally connected is needed if the intuitive count policy described in the introduction (according to which undetached parts and disconnected wholes should not be counted) is to make any sense at all. Finally, the third question that I wish to address concerns the possibility of formulating other count policies—other viable ways of drawing up inventories of the world. This question will be taken up in Section 6 and will lead to an examination of various reasonable constraints that can be added to (M), and of their interaction with the underlying mereology.

3. Extensionality

Let us begin with the question of extensionality. Take again the case of Tibbles, the cat. Call her tail ‘Tail’ and the rest of her body ‘Tib’. According to the Minimalist View, when we set ourselves to drawing up an inventory of the world we have two main options: either we count the whole cat, Tibbles (this is the loose count, in Baxter’s terminology), or we count an exhaustive collection of disjoint parts, such as Tib and Tail (strict count)⁶. (There are other options corresponding to other ways of carving out objects, for instance by taking objects that properly overlap both Tibbles and Pluto, but let us ignore these possibilities now.) Indeed, since this is a case where the whole object is not scattered, the loose count might be more natural: there is only one thing—a whole cat. Yet this is precisely where the presupposition of extensionality lies.

⁶ I shall use the loose/strict opposition always in Baxter’s sense. It has nothing to do with Bishop Butler’s opposition (taken up by Chisholm [1969]) between a ‘strict and philosophical’ and a ‘loose and popular’ sense of the ‘is’ of identity.

What are the grounds for saying that there is only *one* whole? Let Tib+Tail be a⁷ mereological sum of Tib and Tail—an entity which is overlapped exactly by those things that overlap either Tib or Tail. What are the grounds for saying that Tibbles is the same as Tib+Tail? This identity reflects the very idea that a whole encompasses the same portion of reality as its constituent parts. Yet a certain familiar argument suggests that it is not unproblematic.

Here is one way of putting this familiar argument.⁸ Suppose that one day there is an accident and Tibbles' tail is cut off. Every cat can survive the loss of her tail, or so we may suppose, hence Tibbles will continue to exist but will no longer include Tail among its parts. A sum of Tib and Tail, however, must by definition consist of both those parts, Tib and Tail, so it will include Tail also after the accident, if the tail is not destroyed. And if the tail is destroyed, then after the accident Tib+Tail will just no longer exist. Either way, Tibbles and Tib+Tail seem to have different persistence conditions, different properties. *Ergo*—the argument goes—by the principle of the indiscernibility of identicals Tibbles and Tib+Tail must be two different things. Schematically:

- (1) After the accident, Tail will not be part of Tibbles.
 - (2) After the accident, Tail will be part of Tib + Tail.
-
- (3) Thus, Tibbles and Tib+Tail have different persistence conditions and must be kept distinct (even before the accident).

This is the version where the tail is not destroyed in the accident, but only cut off. Otherwise the argument goes like this:

- (1') After the accident, Tibbles will still exist.
 - (2') After the accident, Tib + Tail will no longer exist.
-
- (3') Thus, Tibbles and Tib+Tail have different persistence properties and must be kept distinct (even before the accident).

⁷ Above I spoke of *the* sum of two given entities $x+y$, but of course the uniqueness of a mereological sum presupposes extensionality.

⁸ The puzzle has been introduced to contemporary philosophical discussion by Wiggins [1968], apparently drawing on Peter Geach (who attributes it to William of Sherwood: see the *sophisma* in [1968: 60-61]). It actually goes back at least to the Stoics (see e.g. Sedley [1982], Sorabji [1988: §1.6]). For a selection of recent relevant literature, see Rea [1997].

Nor is the actual occurrence of the accident a necessary condition for this sort of argument to be formulated. One could just argue that Tibbles *can*, whereas Tib+Tail *cannot* (by definition), cease to include Tail as part. For this would imply that Tibbles and Tib+Tail have different properties—different *modal* properties—and that is all one needs to distinguish them. Schematically:

(1") Tail is not necessarily part of Tibbles.

(2") Tail is necessarily part of Tib + Tail.

(3") Thus, Tibbles and Tib+Tail have different modal properties and must be kept distinct (even in this world).

If these arguments are accepted, then, in front of us there would now be not one entity, a cat, but two entities, a cat and a mereological sum comprising her body and her tail. Indeed, by the same pattern we could distinguish many other entities in front of us: a sum consisting of the left ear and the remainder, a sum consisting of the right ear and the remainder, and so on. I will come back to this later. For the moment let me just emphasize that this sort of argument, if sound, would introduce a serious problem for the Minimalist View. For suppose we are drawing up an inventory of the world at time t_0 , before the accident. Suppose we are doing this according to the loose count: we want to list only connected wholes, and no undetached parts. What shall we include—Tibbles or Tib+Tail? If these are not the same whole, then we have to choose. For they have the same parts, hence they overlap, and so by (M) only one should count. But *which* one? (The problem would also arise if we preferred a stricter count, counting for instance two things, Tib and Tail, rather than one, Tibbles, or Tib+Tail. For then one could run the argument with regard to the parts. Let 'T' denote an initial bit of Tail, and let 'Ail' denote the rest . . . In the following I shall focus on the loose count for simplicity.)

Of course, if one believes in contingent identity the problem dissolves: one can just say that Tibbles and Tib+Tail are different at certain times or worlds, where they have different parts, but not at this time in this world, where they have the same parts.⁹ That is good enough to save the Minimalist View. On the other hand, suppose we reject contingent identity. Then there are various ways

⁹ This is the strategy urged by Gibbard [1975] and Myro [1985] (with respect to worlds and times, respectively) and recently defended by Gallois [1998].

of saving mereological extensionality *vis à vis* these arguments, but they are of little help for our purposes—at least to the extent that we want our inventories of the world to represent our ontological commitments in agreement with the Minimalist View. One could, for example, subscribe to a four-dimensional ontology and insist that Tibbles and Tib+Tail are indeed distinct because they have different *temporal parts*.¹⁰ Or one could take extensionality to mean that distinct things must have different parts *at some time or other* or *in some world or other* (though not necessarily at every time and in every world). In that case the conclusion of the arguments is unproblematic as long as we give up the traditional (Lockean) principle to the effect that distinct bodies can never simultaneously occupy the same spatial region.¹¹ (And there are certain kinds of entity for which this principle seems to fail anyway: holes, shadows, perhaps ghosts.¹²) Whatever their merits, however, these are not ways out for the Minimalist View. For these temporal and modal variants of extensionality are not what the Minimalist View presupposes. If we accept the conclusion of the argument (in any of its versions) on account of temporal or modal differences between Tibbles and Tib+Tail, it simply becomes impossible to draw up inventories of the world except with reference to the full history (past, present, and future) of everything included in the domain (let alone its history in other possible worlds). And for the Minimalist View this would be a meager achievement: one would not avoid double counting; rather, one would find reasons to make sense of it.

If we do not want to accept the conclusion, however (and if we do not want to give up the principle of the indiscernibility of identicals), then we must reject one of the premises. And again the question is: *which* one? A denial of the first premise (the proposition that Tail will or would cease to be part of Tibbles after the accident), amounts to a form of mereological essentialism that does not

¹⁰ As urged e.g. by Heller [1984] and, more recently, Sider [1997].

¹¹ This is the position of Thomson [1983].

¹² The case of holes is discussed at some length in Casati and Varzi [1994: Ch. 7]; shadows were suggested by Leibniz in his commentary of Locke [*New Essays*, II-xxvii-1], van Inwagen [1990: 81] mentions ghosts, and David Lewis [1991: 75] has two angels dancing forever on the head of a pin. Chisholm [1973: 590] also considers shadows and holes as counterexamples to Locke's principle. For another example, J. M. Shorter [1977] mentions the intriguing case of intersecting clouds produced by two distinct "cloud projectors". For a general discussion, see Casati and Varzi [1996].

seem to be implied by the Minimalist View. And how can we possibly deny the second premise (the premise that Tib+Tail will or would still include Tail after the accident, if it survives at all)? Perhaps we could say that after the accident Tib+Tail ceases to exist insofar as its parts get separated, and we could therefore treat the second premise as false or truth-valueless. But this would seem to imply an equally delicate form of essentialism—a form of *topological* essentialism whereby the identity and existence conditions of a mereological sum depend on the arrangement of its constituent parts.¹³

I don't know which of these premises must be rejected. Still, maybe we don't need to choose in order to resist the argument and the threat that it represents for the Minimalist View. For let us be careful here. There are two ways of reading the premises, depending on whether the terms occurring therein are understood *de dicto* or *de re*. And I think the *prima facie* plausibility of the argument ultimately rests on this ambiguity. Consider first the *de dicto* reading, and focus on the first version of the argument, (1)–(3). I agree that on this reading the two premises can hardly be rejected. The first premise reads:

(1_{dd}) The entity picked out by the term 'Tibbles' at time t_1 (after the accident) will not include Tail as part,

and this simply reflects our way of using the term 'Tibbles' in the envisaged situation. The second premise reads:

(2_{dd}) The entity picked out by the term 'Tib+Tail' at time t_1 (after the accident) will include Tail as part,

and again this simply reflects our use of the term 'Tib+Tail', which must pick out a mereological sum of Tib and Tail. So, on a *de dicto* reading both premises of the argument are naturally accepted. However, this is clearly beyond the point. For if we are interested in the temporal properties of the entity or entities that are *now* in front of us, then we should not look at the future referents of our names and descriptions. Obviously, if those names and descriptions have different senses (as in our examples), they may have different referents at different times. Obviously, the terms 'Bill Clinton' and 'the US president' may

¹³ The first option—mereological essentialism—is Chisholm's favored strategy [1973], while the second option—topological essentialism—may be associated with those who feel uncomfortable with scattered fusions (see Casati and Varzi [1999a] for discussion).

pick out different people at different times. But that is not the issue. The issue is not whether our terms *will* have different referents. It is whether they *do* have different referents, whether they have different referents at this time. So, on a *de dicto* reading the premises may well be true, but the argument is not valid. The conclusion does not follow.

It is the *de re* reading that matters, then. But on a *de re* reading (1) and (2) are in the same boat:

- (1_{dr}) The entity picked out by the term ‘Tibbles’ now—*that* particular entity—is such that at time t_1 (after the accident) *it* will not include Tail as part.
- (2_{dr}) The entity picked out by the term ‘Tib+Tail’ now—*that* particular entity—is such that at time t_1 (after the accident) *it* will include Tail as part.

If Tibbles is *not* Tib + Tail, then fine, we are talking about two different entities, and perhaps we can say that both (1_{dr}) and (2_{dr}) are true. But this opposition would be *prior* to our thought experiment—it cannot be inferred from it and calls for independent grounds. We can’t distinguish two entities by looking at *their* properties unless we already know what *they* are, at least unless we already know whether they are distinct. On the other hand, if Tibbles *is* Tib + Tail—and to rule that out would be to beg the question—then *that particular entity* is the same in both cases, so (1_{dr}) and (2_{dr}) cannot be both true. (And which one we reject will reflect our views on mereological essentialism. Maybe we want to say that Tibbles cannot exist without Tail, making (1) false; maybe we want to deny that, making (2) false.) In short, on a *de re* reading this sort of non-identity argument is valid, but it is either unsound or question begging: one can have reasons to accept the two premises only if one *already* has reasons to distinguish between Tibbles and Tib+Tail in the first place.¹⁴ Since the *de re* reading is the only one that matters (and since on a *de dicto* reading the

¹⁴ My point here is similar to that of Della Rocca [1996], though my concern is with mereological rather than material constitution. In a similar fashion, Neale [1990, §4.6] argues that this sort of *de re / de dicto* ambiguity is responsible for a certain confusion surrounding the discussion on events and event identity. I shall come back to this below. The basic point, of course, owes much to Smullyan [1948] and Kripke [1972] (see e.g. Kripke’s discussion of the identity of heat and molecular motion, pp. 129ff).

argument is fallacious anyway), this means that the argument fails to establish the distinction.

Of course, the identification of Tibbles and Tib+Tail may give rise to some awkwardness when it comes to the way we speak. If we are not essentialists about Tibbles, and if Tibbles = Tib+Tail, then we must accept premise (1) and reject premise (2). Yet the denial of premise (2), i.e., the statement that after the accident Tib + Tail will not include Tail, sounds awkward. Indeed. But what follows from this? Not that we are forced to accept (2) instead and reject (1). It simply follows that the negation of (2) is not a good way of expressing the proposition that the one entity we are talking about will cease to include Tail as part—the proposition that after the accident Tail will no longer be part of that entity. If we think that this proposition is true (if we are not essentialists about tails), then sentence (1) is a much better way of expressing it than the negation of (2). Certainly we shall speak this way *after* the accident—we shall say ‘Now Tail is no longer part of Tibbles’ rather than ‘Now Tail is no longer part of Tib+Tail’—for then the term ‘Tib+Tail’ does not even refer to the entity we intend to talk about.

Bennett [1973] and Anscombe [1979] actually pointed out that this sort of awkwardness may arise all the time: a man cannot truly be called a husband before the wedding, or after a divorce, and a person cannot be called a killer before the death of the victim. It would have been wrong to refer to Brutus as the murderer of Caesar before Caesar had died. Yet this is not to say that when we now speak of Brutus and when we speak of the murderer of Caesar we are speaking of two different entities. We are speaking of a person who—as things turned out—murdered Caesar. On a *de re* reading, the sentence ‘The murderer of Caesar had already left when Caesar died’ may sound awkward, but it is perfectly meaningful. And it may well be true.

In short, then, the non-identity argument (1)–(3) is either invalid (on a *de dicto* reading) or question begging (on a *de re* reading). And the same goes for the other versions of the argument. Take for instance the modal version, (1'')–(3''). On the *de dicto* reading, the premises simply assert that the terms ‘Tibbles’ and ‘Tib+Tail’ have different senses, from which it certainly does not follow that they have different referents. On the *de re* reading, the argument says that we can distinguish the entities picked out by ‘Tibbles’ and ‘Tib+Tail’ by looking at their modal properties. But we simply cannot look at *their* properties unless we already know what *they* are, at least whether they are distinct. We

must know how many passengers we are taking along before we can embark in other-worldly philosophical excursions. Indeed, why should we be able to settle identity issues in this world by looking at other worlds? Why should identity across possible worlds be easier to handle than identity within this world?

This diagnosis, I think, applies to a whole family of non-identity arguments, even arguments that have nothing to do with mereological sums. Take Tibbles and Sitting-Tibbles, the material body arranged in the shape of Tibbles now that she is sitting on the mat. Or take Tibbles and the lump of feline tissue of which she is presently constituted. Or take Tibbles' accident (the event when she lost her tail) and her painful accident (when she painfully lost her tail). In each of these cases, some philosophers would distinguish between the first and the second member of the pair precisely on account of their different temporal or modal properties. Tibbles can get up, but Sitting-Tibbles cannot. Tibbles could be made of different tissue, but the lump of feline tissue that constitutes her could not. Tibbles' accident could have been painless, but her painful accident could have not.¹⁵ In each of these cases, I submit, the argument is either invalid (if read *de dicto*) or question begging (if read *de re*). Of course the terms 'Tibbles' and 'Sitting-Tibbles' have different senses; but it does not follow that they have different referents.¹⁶ And if their referent is the same, if they name the same thing now that Tibbles is sitting on the mat, then either *that thing* can get up or *it* cannot. Of course the terms 'Tibbles' and 'that lump of feline tissue' have different senses. But if they have the same referent, if Tibbles *is* that lump of feline tissue, then Tibbles and the lump have exactly the same properties, here and in every possible world. And of course the predicates 'accident' and 'painful accident' pick out different properties, which entails that the event descriptions 'Tibbles' accident' and 'Tibbles' painful accident' have different senses. It does not, however, follow that the two descriptions have different referents: if the accident was painful, both phrases may refer to the same event (though with different, increasing degree of precision).

¹⁵ On material constitution (the cat vs. the lump of feline tissue), see e.g. Fine [1994] and Thomson [1998]. On events (the accident vs. the painful accident), see e.g. Brand [1977: 334] or Yablo [1987]. The latter case is discussed in some detail in Pianesi and Varzi [1999].

¹⁶ In Aristotle's terms, "the 'accidental' is, in a way, but a name" [*Metaphysics* 1026^b14]. Brentano [1933] took this to imply that the accident is a modal extension of the substance, but that would resuscitate the puzzle. For a discussion, see Chisholm [1978] and Smith [1994: §§ 3.3–3.5].

4. Cats-in-waiting

With all this, I have not given any argument *for* mereological extensionality. But I hope to have shown that the *prima facie* plausibility of the familiar arguments *against* extensionality founders upon the necessary disentanglement of semantic and ontological issues. Language involves a lot of doubling up. But why should we take that to imply a corresponding doubling up in the ontology? Why should a plenitude of *nomina* correspond to a plenitude of *nominata*? To me this is sufficient to establish the meaningfulness of extensionality, hence to provide grounds for the Minimalist View.

It is worth pointing out that this line of reasoning applies also to other versions of the non-identity argument. For instance, consider the following version, which concerns the number of entities at time t_1 (after the accident) rather than t_0 (before the accident). We know that Tib and Tibbles have the same parts at t_1 . But we also know that Tib and Tibbles have different parts at t_0 : before the accident Tail is part only of Tibbles, not of Tib. So isn't this enough to conclude that Tibbles is different from Tib at t_1 , even though they have the same parts?¹⁷ Schematically:

- (4) Before the accident, Tail was part of Tibbles.
 - (5) Before the accident, Tail was not part of Tib.
-
- (6) Thus, Tibbles and Tib have different persistence conditions and must be kept distinct (even after the accident).

As I see it, this argument is perfectly similar to the previous one(s), except that its question-begging character (on the *de re* reading) is now reversed. We are looking at Tibbles at t_1 —*that* tailless thing—and we are saying that at t_0 *it* included Tail as part; we are looking at Tib—*that* tailless thing—and we are saying that *it* did not include Tail as part. If Tibbles and Tib are distinct, then we may well be right. But if Tibbles and Tib are one and the same (as I should like to think), then one of our statements (*de re*) is simply false. That one thing could not have been such as to both have and not have Tail as part. To put it differently, we may assume the premises to be true; but then the conclusion

¹⁷ It is mostly in this form that the puzzle has been discussed in the literature. See Simons [1987, §3.3] and the introduction to Rea [1997] for comparisons and overviews.

follows only on the supposition there are *still two* entities after the accident, which is exactly what the argument is supposed to establish. (In the arguments of Section 3, the conclusion followed only on the supposition that there are *already two* entities before the accident.)

Of course, one can find good reasons in support of this supposition. Common sense wants Tibbles to survive the loss of Tail. And why should Tib not survive? As already Philo of Alexandria put it (in his discussion of Chrysippus' suggestion that only Tibbles would survive the accident):

How can it be that [Tib], who has had no parts chopped off, has been snatched away, while [Tibbles], whose [tail] has been amputated, has not perished? [*Aet. mundi* 48]¹⁸

I don't know how that can be. But this is now a different issue and there seem to be many ways of dealing with it. For instance, it is true that Tib has had no parts chopped off in the accident. But that does not mean that Tib was not affected by the accident. On the contrary, the detachment of Tail was a major topological change that may well have had drastic effects on Tib: the boundary around that lump of feline tissue is now complete, whereas it was not at t_0 .¹⁹ Likewise, the survival of Tibbles is itself a complicated business. We are inclined to say that it survives, I suppose, insofar as Tibbles is a cat, and we are inclined to say that cats can survive small mereological changes. If instead of a real cat Tibbles were a china cat, say, one would reason differently. When the statue breaks into two pieces, Tib and Tail, we might want to say that it does not survive the accident. Or, if it survives, we might want to say that after the accident the statue still includes Tail among its parts. "Look, Tibbles is broken. One part of it is on the floor near the sofa, the rest is near the coffee table." I simply don't think our intuitions about survival through time are clearer and more basic than our intuitions about synchronic identity. So I don't find the non-identity argument in this form any more compelling than in the forms considered earlier.

¹⁸ I quote from Sedley [1982: 268] (altering Philo's original to fit our example.) Burke [1994] is to be credited for bringing Chrysippus' suggestion back into current discussions.

¹⁹ This is how I would reply to Philo's *prima facie* intuitive remarks. *Contra* Denkel [1995], we are *not* talking about a Cambridge change that mysteriously results in a substantial change—for topological relations are not Cambridge relations. A similar point is made in Burke [1996: 66], though towards a different conclusion. See also Smith [1992] for a pertinent discussion of the Tib+Tail puzzle from this perspective.

One could still consider a derivative problem, though. If Tibbles (or Tib, or whatever is left after the accident) truly deserves being called a cat after the loss of Tail, wouldn't it be correct to call *Tib* a cat before the accident? After all, before the accident Tib comprises exactly the same lump of feline tissue as Tibbles does after the accident (or so we may suppose). Indeed, since we can raise the same question for any proper part of Tibbles that is similar enough to deserve being called a cat upon detachment of the remainder (any part, for instance, that entirely coincides with Tibbles except for her left ear, or except for a single hair), what prevents one from saying that at t_0 we have a plethora of cats, not one? (This way of describing the situation is sometimes referred to as the “problem of the many”.²⁰) This is not immediately a problem for the Minimalist View, since (M) rules out at the outset the possibility that overlapping entities (Tibbles minus hair x and Tibbles minus hair y , for instance) be included in the same inventory of the world. Still one can raise the question: If the smaller parts truly deserve to be called cats—albeit only *potential* cats, or “cats-in-waiting”²¹—for what reason should we count only the maximal one (on the loose count)? Alternatively, on what grounds could we ever pick out one of those proper parts as the only cat to be included in the inventory (on a stricter count)?

This question is legitimate, but I think it reflects a concern that is more appropriately regarded as semantic, not ontological. If there is a sense in which Tib and countless many other proper parts of Tibbles have a claim to being a cat at t_0 , it is because the rules of language do not set forth any rigid restrictions on the use of the word ‘cat’ with regard to mereological composition (the possession of a tail or of a hair in a certain spot.) The word ‘cat’, we may say, is vague, like ‘table’ or ‘heap’. But that goes hand in hand with a very precise convention governing the use of these words, namely that cats, like tables or heaps, are maximal entities. As Quine put it, pondering upon the graded multitude of nested or overlapping tables-in-waiting that are contained in a table:

Each of these physical objects would qualify as a table, that is, if cleared of the overlying and surrounding molecules, but should not be counted as a table when still embed-

²⁰ In this version the puzzle comes from Geach [1980: §110]. Unger [1979, 1980], uses it to argue toward the nihilist conclusion that ordinary objects don't exist. Kim [1976: 170] draws an analogy with the problem of event individuation.

²¹ The terminology is from Michaels [1983: 102].

ded in a further physical object that so qualifies in turn; for tables are meant to be exclusive. Only the outermost, the sum of this nest of physical objects, counts as a table. [1981: 92–93]

So surely there are many cats-in-waiting contained in Tibbles at t_0 , and each of them would deserve to be called a cat upon removal of the remainder. But none of them *is* a cat. So none of them should be counted if we are counting cats (on the loose count). And none of them would be a lucky cat randomly chosen from a plethora of equally good candidates, if we are counting more strictly; it would be a randomly chosen cat-in-waiting, and that is perfectly unproblematic.

5. Connectedness

One could still point out a loose end in the foregoing. Briefly put: just what is a maximal cat (table, heap)? More generally, what is a *maximally* connected body? The intuition seems clear when we speak of Tibbles and Tib+Tail after the accident. But how can that intuition be formalized? Moreover, at some deeper level of description we know very well that ordinary material bodies are not topologically connected (in one piece). So how can we speak of connected things at all?

Here the answer comes in two steps. First, the existence of connected wholes (and of the relevant boundaries) depends on the underlying mereology—more precisely, on the topological features of the domain fixed by the mereological theory that we are assuming (the theory that delivers the ontological commitments according to the Quinean notion). And these topological features are to be thought of as lying at the same conceptual level as every other part-whole relation. Of course, if our mereology reflects the microscopic organization of the physical world, if the solid bodies of common sense are analyzed as intricate systems of subatomic particles, then no such body will have a topologically connected boundary, except in a loose manner of speaking. In that case, the relevant notion of connectedness is not strictly topological. For instance, one could speak of tables and cats as being *causally* connected, or *functionally* connected, or perhaps also *teleologically* connected. There might be vagueness and other difficulties involved in these notions; but that need not be a concern for the Minimalist View. On the other hand, if our set of mereological

cookie cutters is not so fine-grained—if our mereology reflects the organization of the physical world at a macroscopic level—then the relevant notion of connectedness may well be topological in a strict sense. It may not be the topology of the world from the physicist’s point of view, but it will be the topology of our domain as it is fixed by our mereological theory. And for the Minimalist View that is all that matters.

The second part of the answer concerns maximality. Let us focus on the case of maximal *topological* connectedness. We may define connectedness as follows, paralleling the ordinary point-set-theoretic definition:²²

- (7) x is self-connected (i.e., in one piece) if and only if any two parts that add up to x are connected to each other (i.e., either touch or overlap).

This is not unproblematic, since a lot depends on the relevant notion of touching, which is itself a source of philosophical puzzlement. (How can two things be exactly *next* to each other, if space is dense?) However we need not go into the details here: any notion of genuine topological contact should do—such as the relation of contact that holds between the tail and the rest of Tibbles, as opposed to the relation of mere physical closeness that may obtain between Tibbles and the mat she is sitting on.²³ Given (7), the relevant notion of maximality is then to be understood as a means for expressing the intuitive distinction between self-connected *parts* (such as Tib) and self-connected *wholes* (Tibbles). As a preliminary characterization, this can be obtained simply by exploiting the fact that parthood is a partial ordering:²⁴

- (8) x is maximally self-connected if and only if (i) x is self-connected and (ii) every self-connected y is either disjoint from x or included in x .

This says why Tib should not, while Tibbles should, count as maximal in the relevant sense. For, intuitively, Tib does not—while Tibbles does—satisfy the condition in (8)(ii). More generally, this characterization captures the intuiti-

²² This notion was first given philosophical content by Cartwright [1975: 174]. The mereotopological definition adopted here follows in the footsteps of Tiles [1981: 56], Hirsch [1982: 97], Chisholm [1992/3], and Smith [1996], *inter alia*.

²³ On these issues I refer to Varzi [1996a, 1997] and to Casati and Varzi [1996, 1999b]. See also Zimmerman [1996] for the historical background.

²⁴ See Smith 1996, §9.

tive difference between Tibbles and the many cats-in-waiting properly included in Tibbles at t_0 . But there is still one problem. As it stands, (8) quantifies over all entities included in the domain of our mereological theory. And since it is plausible to assume that everything is connected to its mereological complement, it may well be that nothing is maximally connected *strictu sensu*, except for the entire universe. In other words, (8) will not make Tibbles maximally connected after all, because (8) is not about cats, or about physical objects; it is about everything. To obtain the desired formulation, we must instead rely on the relevant categorical distinctions. We must rely, not on a predicate of absolute maximal self-connectedness, but on a parametrized predicate of maximal self-connectedness *relative to entities of a kind* , or *-maximal self-connectedness* for short:

- (9) x is *-maximally self-connected* if and only if (i) x is a , (ii) x is self-connected, and (iii) every y that is a and is self-connected is either disjoint from x or included in x .

In the passage from Quine quoted above, was just the property of being a physical object, but we can hardly leave it at that. Any body of air surrounding Tibbles may qualify as a physical object in the relevant sense, if Tibbles does. It is, rather, properties or conditions of qualitative homogeneity (of material composition, density, texture, electric charge, etc.) that are relevant to the point at issue. Qualitative discontinuities introduce physical boundaries; so being maximal with respect to a condition of qualitative homogeneity is to be demarcated by a complete physical boundary. What these conditions are may be matter of controversy and may depend heavily on context and cognitive factors. But suppose we take ‘made of feline tissue’ to be such a condition . Then Tibbles is, and Tib is not, *-maximally self-connected*. In fact Tibbles is a cat insofar as it is made-of-feline-tissue-maximally-self-connected: there exists no bigger self-connected entity made of feline tissue of which Tibbles is part.²⁵ Tib, on the other hand, is not so connected (at t_0), since it is properly included in Tibbles.

²⁵ Of course, there are groups of physical objects that properly include Tibbles and that appear to form a connected whole, e.g., the sum of Tibbles and the mat she is sitting on. However this is not a case of topological connection in the sense presupposed by (7) but, as already mentioned, a case of mere physical closeness.

With the help of (9), then, the semantic argument of Section 4 is complete. And we are at last in a position to clarify the intuition behind the counting policy described in the introduction—the intuition that an inventory of the world must include only things of the garden variety (things with a complete, continuous boundary). Call this the “garden count policy”. It is the result of supplementing (M) with the maximality condition:

- (G) An inventory of the world is to include an entity x only if x is maximally self-connected with respect to some condition of qualitative homogeneity.

6. Ways of counting

Let us, finally, go back to our options. The Minimalist View solves our initial question on the ontological status of parts by drawing a distinction between a primordial, Quinean notion of existence (to be is to be included in the domain of our mereological theory, whatever it is) and a more selective, cognitively relevant notion (to be is to be included in an inventory of the world, however this is drawn up). The Minimalist View says that, based on the Quinean notion, the selective notion is subject to the additional condition (M). And (G) gives us a further condition, corresponding to the garden count policy.²⁶

Now, the garden count policy is only one among many options. One can imagine stronger or weaker conditions corresponding to stricter or looser count policies. For instance, the strictest count policy is atomistic—never count an entity that has proper parts:

- (A) An inventory of the world is to include an entity x only if x is mereologically atomic.

Of course, this would presuppose that everything in the domain of quantification is ultimately constituted by mereological atoms; otherwise the left-to-right condition of (M) (the non-redundancy condition) could be violated. And if everything is constituted by mereological atoms, then the right-to-left condition of (M) (the completeness condition) entails the converse of (A): every atom is

²⁶ One way of implementing (G) is explored in chapter 6 of Casati and Varzi [1999b], where the following options are also briefly considered.

to be included in the inventory. So this count policy actually amounts to the requirement that the only way to draw up an inventory of the world is to make a list of all and only the mereological atoms in the domain. Everything else is just an aggregate of such primary entities.

By contrast, the loosest possible count is holistic—never count an entity if it is part of something else:

- (H) An inventory of the world is to include an entity x only if x is mereologically maximal.

If the underlying mereology is standard—in particular, if the domain is closed under arbitrary sums—this implies that there is only one entity to be included in an inventory, namely, the sum total of all there is in the Quinean sense. On the other hand, suppose that the sum axiom fails to hold. Suppose the domain includes three things x , y , and z along with $x+y$ and $x+z$, but not $x+y+z$. If, say, $x+y$ is included in the inventory, then $x+z$ cannot be included, owing to the left-to-right condition of (M). But by the right-to-left condition of (M), this means that z must be included, which contradicts (H). Thus, if the domain is not closed under arbitrary sums, then (H) may not be available at all as a supplement to (M).

What intermediate policies are there? The garden count policy (G) is one, but it is itself a rather extreme position: it prevents an inventory from including undetached parts or disconnected wholes of *any* sort. Are there any ways of weakening this conception? I think so. Counting as one is a function of possessing a certain unity. But the relevant notion of unity may vary, and the general notion of n -connectedness does not capture every interesting case. There are circumstances where a stricter criterion than (G) (though not as strict as (A)) seems appropriate; and there are circumstances where it is a looser criterion (but not as loose as (H)) that seems appropriate.

A circumstance of the first sort was illustrated in Section 2 with the bananas example. Though they are topologically connected and qualitatively homogeneous, the cashier may want to count a bunch of five bananas as five distinct items. Here it is the pragmatics of the context that sets the relevant policy, removing the appearance of arbitrariness from the partition. For a different example, consider a simple perforated object such as a doughnut. The doughnut is sure to be connected to its hole—yet one may want to list these entities separately in an inventory of the world. Within the constraints set by

(G) one can rely on the qualitative difference (in terms of material constitution) between the hole and the doughnut. But the hole must also be listed separately from the rest of the doughnut's complement, and that cannot be handled in terms of qualitative discontinuities. A hole is naturally regarded as a homogeneous and yet distinguished undetached proper part of the airy complement of its material host; and one may have reasons to include such a part in an inventory of the world rather than the whole complement, contrary to (G).²⁷ More generally, (G) will be violated whenever we include things that are demarcated, not by a complete *bona fide*, physical boundary, but by a *fiat*, cognitively induced boundary to which there corresponds no physical discontinuity.²⁸ For a further example—from the ontology of geography—two territories may be connected through a common fiat border, like the territories of Maryland and Pennsylvania; yet that does not deprive them from the salience needed to count them separately.²⁹ So if we are willing to put geographic territories in our inventory of the world, then again (G) seems to be violated.

As for the looser counts, these seem appropriate in those cases where a scattered aggregate is bound together in virtue of its being unitary in some relevant sense, as with the bikini example of Section 2. Thus, we are likely to count a pen as one item, even if the cap is not topologically connected to the writing instrument. And an encyclopedia may count as twelve if we are making a list of volumes, but it counts as one if we are setting up a library catalogue. The selective factor may be purely cognitive, or it may be explained in terms of some sort of non-topological (e.g., functional) connectedness, as mentioned in Section 5. In fact, if the mereotopological structure of the domain of reference is as fine-grained as demanded by the physical sciences, then physical objects of the garden variety can only be included in an inventory of the world as a result of such a loosening of (G): no *bona fide* boundary would individuate them.

²⁷ On the ontology and mereotopology of holes see Casati and Varzi [1994] and Varzi [1996b].

²⁸ For the notion of a *fiat* boundary I refer to Smith [1995] and Smith and Varzi [1999].

²⁹ We can speak of the Mason–Dixon line as the border between Maryland and Pennsylvania, but this border is best construed as being made up of two coinciding fiat boundaries, one for each state. (See Smith and Varzi [1999] for details.) The coincidence, however, is purely spatial and involves no mereological overlap, which is why Maryland and Pennsylvania can be counted separately without violating (M). For the same reason, Tib and Tail can be listed separately also before the accident: their fiat boundaries coincide, but share no parts.

Speaking of the table's boundary would be like speaking of the flat top of a fakir's bed of nails,³⁰ and the relevant discontinuity would involve the same degree of arbitrariness as that of any fiat demarcation.

I'm going to leave this part of the story open. The spectrum of available counting policies is presumably very large and to some extent underdetermined. Nonetheless the initial question—the question of how we can talk about parts and wholes while at the same time regarding the former as nothing over and above the latter, or vice versa—that question has at this point a clear enough answer. Our inventory of the world will depend on the underlying mereology (the theory of parts) and on the way we set our standards for unity (the theory of wholes). Not any standard will do, though. And the Minimalist View sets the necessary constraints. Any additional criterion may require a story of its own.³¹

References

- Anscombe G. E. M., 1979, 'Under a Description', *Noûs* 13, 219–233.
- Bennett J., 1973, 'Shooting, Killing, Dying', *Canadian Journal of Philosophy* 2, 315–323.
- Baxter D., 1988, 'Identity in the Loose and Popular Sense', *Mind* 97, 575–582.
- Brand M., 1977, 'Identity Conditions for Events', *American Philosophical Quarterly* 14, 329–337 (reprinted in R. Casati and A. C. Varzi, eds., 1996, pp. 363–371).
- Brentano F., 1933, *Kategorienlehre*, ed. by A. Kastil, Hamburg: Meiner (Eng. trans. by R. M. Chisholm and N. Guterman, *The Theory of Categories*, The Hague, Boston, and London: Nijhoff, 1981).
- Burke M. B., 1994, 'Dion and Theon: An Essentialist Solution to an Ancient Puzzle', *Journal of Philosophy* 91, 129–139.
- 1996, 'Tibbles the Cat: A Modern *Sophisma*', *Philosophical Studies* 84, 63–74.
- Cartwright R., 1975, 'Scattered Objects', in K. Lehrer (ed.), *Analysis and Metaphysics*, Dordrecht: Reidel, pp. 153–171.
- Casati R. and Varzi A. C., 1994, *Holes and Other Superficialities*, Cambridge, MA, and London: MIT Press (Bradford Books).
- 1996, 'The Structure of Spatial Location', *Philosophical Studies*, 82, 205–239.
- 1999a, 'Topological Essentialism', *Philosophical Studies*, in press.

³⁰ The analogy is from Simons [1991: 91].

³¹ Parts of this paper have been delivered at MIT, at the CUNY Graduate Center, and at the universities of Maryland, Buffalo, and Padua. Many thanks to the participants in those meetings for inspiring discussions. I am also grateful to Andrea Bottani, Daniele Giaretta, Noa Latham, Barry Smith, and an anonymous referee for detailed comments on earlier drafts.

- 1999b, *Parts and Places. The Structures of Spatial Representation*, Cambridge, MA, and London: MIT Press (Bradford Books).
- Casati R. and Varzi A. C., eds., 1996, *Events*, Aldershot: Dartmouth Publishing.
- Chisholm R. M., 1969, 'The Loose and Popular and the Strict and Philosophical Senses of Identity', in N. S. Care and R. H. Grimm (eds.), *Perception and Personal Identity*, Cleveland: The Press of Case Western Reserve University, pp. 82–106.
- 1973, 'Parts as Essential to Their Wholes', *Review of Metaphysics* 26, 581–603.
- 1978, 'Brentano's Conception of Substance and Accident', *Grazer philosophische Studien* 5, 197–210.
- 1992/3, 'Spatial Continuity and the Theory of Part and Whole. A Brentano Study', *Brentano Studien* 4, 11–23.
- Della Rocca M., 1996, 'Essentialists and Essentialism', *Journal of Philosophy* 93, 186–202.
- Denkel A., 1995, 'Theon's Tale: Does a Cambridge Change Result in a Substantial Change?', *Analysis* 55, 166–170.
- Dummett M., 1973, *Frege: Philosophy of Language*, London: Duckworth.
- Fine K., 1994, 'Compounds and Aggregates', *Noûs* 28, 137–158.
- Frege G., 1884, *Die Grundlagen der Arithmetik. Eine logisch-mathematische Untersuchung über den Begriff der Zahl*, Breslau: Köbner (Eng. trans. by J. L. Austin, *Foundations of Arithmetic*, Oxford: Basil Blackwell, 1950).
- Gallois A., 1998, *Occasions of Identity. The Metaphysics of Persistence, Change, and Sameness*, Oxford: Clarendon Press.
- Geach P. T., 1980, *Reference and Generality*, 3rd ed., Ithaca: Cornell University Press.
- Gibbard A., 1975, 'Contingent Identity', *Journal of Philosophical Logic* 4, 187–221 (reprinted in M. Rea, ed., 1997, pp. 93–125).
- Heller M., 1984, 'Temporal Parts of Four Dimensional Objects', *Philosophical Studies* 46, 323–334 (reprinted in M. Rea, ed., 1997, pp. 320–330).
- Hirsch E., 1982, *The Concept of Identity*, New York and Oxford: Oxford University Press.
- Kim J., 1976, 'Events as Property Exemplifications', in M. Brand and D. Walton (eds.), *Action Theory*, Dordrecht: Reidel, pp. 159–177 (reprinted in R. Casati and A. C. Varzi, eds., 1996, pp. 117–35).
- Kripke S., 1972, 'Naming and Necessity', in D. Davidson and G. Harman (eds.), *Semantics of Natural Language*, Dordrecht/Boston: Reidel, pp. 253–355, addenda pp. 763–769; reprinted as *Naming and Necessity*, Cambridge, MA: Harvard University Press, 1980.
- Leonard H. S. and Goodman N., 1940, 'The Calculus of Individuals and Its Uses', *Journal of Symbolic Logic* 5, 45–55.
- Leśniewski S., 1916, *Podstawy ogólnej teorii mnogości. I*, Moskow: Prace Polskiego Kola Naukowego w Moskwie, Sekcja matematyczno-przyrodnicza (Eng. trans. by D. I. Barnett, 'Foundations of the General Theory of Sets. I', in S. Leśniewski, *Collected Works*, ed. by S. J. Surma, J. Szrednicki, D. I. Barnett, F. V. Rickey, Warsaw: PWN; Dordrecht, Boston, and London: Kluwer, 1992, Vol. 1, pp. 129–173).
- Lewis D. K., 1991, *Parts of Classes*, Oxford and Cambridge, MA: Basil Blackwell.

- Lowe E. J., 1989, 'What is a Criterion of Identity?', *The Philosophical Quarterly* 39, 1–21.
- Michaels M., 1983, 'Identity Through Time: One Last Run for the Ordinary View', *Pacific Philosophical Quarterly* 64, 97–109.
- Myro G., 1985, 'Identity and Time', in R. E. Grandy (ed.), *The Philosophical Grounds of Rationality: Intentiona, Categories, and Ends*, Oxford: Clarendon Press, pp. 383–409 (reprinted in M. Rea, ed., 1997, pp. 148–172).
- Neale S., 1990, *Descriptions*, Cambridge, MA: MIT Press.
- Pianesi F. and Varzi A. C., 1999, 'Events and Event Talk: An Introduction', in J. Higginbotham, F. Pianesi, and A. C. Varzi (eds.), *Speaking of Events*, New York: Oxford University Press, pp. 3–47.
- Putnam H., 1987, *The Many Faces of Realism*, La \, IL: Open Court.
- Quine W. V. O., 1939, 'Designation and Existence', *Journal of Philosophy* 36, 701–709.
- 1981, 'What Price Bivalence?', *Journal of Philosophy* 78, 90–95.
- Rea M., 1997, *Material Constitution. A Reader*, Lanham, MD: Rowman & Littlefield.
- Sedley D., 1982, 'The Stoic Criterion of Identity', *Phronesis* 27, 255–275.
- Shorter J. M., 1977, 'On Coinciding in Space and Time', *Philosophy* 52, 399–408.
- Sider T., 1997, 'Four-Dimensionalism', *The Philosophical Review* 106, 197–231.
- Simons P. M., 1987, *Parts. A Study in Ontology*, Oxford: Clarendon Press.
- 1991, 'Faces, Boundaries, and Thin Layers', in A. P. Martinich and M. J. White (eds.), *Certainty and Surface in Epistemology and Philosophical Method. Essays in Honor of Avrum Stroll*, Lewiston: Edwin Mellen Press, pp. 87–99.
- Smith B., 1992, 'Characteristica Universalis', in K. Mulligan (ed.), *Language, Truth and Ontology*, Dordrecht: Kluwer, 50–81.
- 1994, *Austrian Philosophy. The Legacy of Franz Brentano*, Chicago and La Salle, IL: Open Court.
- 1995, 'On Drawing Lines on a Map', in A. U. Frank and W. Kuhn (eds.), *Spatial Information Theory*, Berlin and Heidelberg: Springer-Verlag, pp. 475–484.
- 1996, 'Mereotopology: A Theory of Parts and Boundaries', *Data & Knowledge Engineering* 20, 287–303.
- Smith B. and Varzi A. C., 1999, 'Fiat and Bona fide Boundaries', *Philosophy and Phenomenological Research*, to appear.
- Smullyan A. F., 1948, 'Modality and Description', *Journal of Symbolic Logic* 13, 31–37.
- Sorabji R., 1988, *Matter, Space, and Motion. Theories in Antiquity and Their Sequel*, Ithaca, NY: Cornell University Press.
- Thomson J. J., 1971, 'The Time of a Killing', *Journal of Philosophy* 68, 115–232.
- 1983, 'Parthood and Identity Across Time', *Journal of Philosophy* 80, 201–220 (reprinted in M. Rea, ed., 1997, pp. 25–43).
- 1998, 'The Statue and the Clay', *Noûs* 32, 149–173.
- Tiles J. E., 1981, *Things That Happen*, Aberdeen: Aberdeen University Press.
- Unger P., 1979, 'There Are No Ordinary Things', *Synthese* 41, 117–154.
- 1980, 'The Problem of the Many', *Midwest Studies in Philosophy* 6, 411–467.

- Van Inwagen P., 1981, 'The Doctrine of Arbitrary Undetached Parts', *Pacific Philosophical Quarterly* 62, 123–37 (reprinted in M. Rea, ed., 1997, pp. 191–208).
- 1987, 'When Are Objects Parts?', *Philosophical Perspectives* 1, 21–47.
- 1990, *Material Beings*, Ithaca, NY, and London: Cornell University Press.
- Varzi A. C., 1996a, 'Parts, Wholes, and Part–Whole Relations: The Prospects of Mereotopology', *Data & Knowledge Engineering*, 20, 259–286.
- 1996b, 'Reasoning about Space: The Hole Story', *Logic and Logical Philosophy* 4, 3–39.
- 1997, 'Boundaries, Continuity, and Contact', *Noûs*, 31, 1–33.
- Wiggins D., 1968, 'On Being in the Same Place at the Same Time', *Philosophical Review* 77, 90–95 (reprinted in M. Rea, ed., 1997, pp. 3–9).
- 1980, *Sameness and Substance*, Oxford: Basil Blackwell.
- William of Sherwood, 1968, *Treatise on Syncategorematic Words*, trans. by N. Kretzmann, Minneapolis: University of Minnesota Press.
- Yablo S., 1987, 'Identity, Essence, and Indiscernibility', *Journal of Philosophy* 84, 293–314.
- Zimmerman D. W., 1996, 'Indivisible Parts and Extended Objects: Some Philosophical Episodes from Topology's Prehistory', *The Monist* 79, 148–180.