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THE MOON AND SIXPENCE:
A DEFENSE OF MEREOLOGICAL UNIVERSALISM

The thesis I am called upon to defend is this: given any collection of objects, no matter how disparate or widely scattered, there is a further object composed of them all. For example, there is an object composed of my left tennis shoe and the lace that is threaded through its eyelets—so far, perhaps, no surprise. But there are all of the following objects as well: the object composed of the lace threaded through my left shoe and the lace threaded through my right shoe; the object composed of the Eiffel Tower and the tip of my nose; the object composed of the moon and the six pennies scattered across my desktop. For any objects *a* through *z*, whatever and wherever they may be, there is an object having those objects as its parts. This thesis goes by several names: conjunctivism (Chisholm), unrestricted composition (Lewis), and mereological universalism (van Inwagen).¹ It is often thought to fly in the face of common sense, but it has won the allegiance of several philosophers, and it is a standard element in the formal theory of part and whole as it was developed in the twentieth century. In what follows I shall explain why I believe it to be true.

¹ Roderick Chisholm used the term ‘conjunctivism’ in his lectures. David Lewis uses the term ‘unrestricted composition’ in *On the Plurality of Worlds* (Oxford: Blackwell, 1986), pp. 211-13, and Peter van Inwagen uses the term ‘universalism’ in *Material Beings* (Ithaca, N.Y.: Cornell University Press, 1990), p. 74. Of these three authors, only Lewis espouses universalism.

1. Classical mereology

Mereology (from the Greek word *meros* for 'part') is the theory of part and whole.

Lesniewski (1916), Tarski (1937), and Leonard and Goodman (1940) have all presented formal systems of mereology, with definitions, axioms, and proofs of theorems.² To give the flavor of these systems, I shall present some of their key definitions and axioms here.

Let us take as primitive the relation symbol ' $x < y$ ' for ' x is part of y '. Other mereological notions can then be defined as follows:

x is a *proper part* of y iff x is a part of y & $x \neq y$. (A proper part of something is a part of it that is distinct from the whole.)

x and y *overlap* (sometimes symbolized ' $x o y$ ') iff for some object z , z is part of x and z is part of y . (Things that overlap are things that have a part in common.)

x and y are *disjoint* iff x and y do not overlap. (Disjoint things are things with no part in common.)

Now for a notion that will be of special importance to us here, the notion of a mereological sum (or fusion). Tarski defines it thus:

x is a *sum* of set A iff $(y)(y \text{ is a member of } A \rightarrow y < x)$ & $(y)(y < x \rightarrow \exists z(z \text{ is a member of } A \text{ \& } y o z))$. (In other words, every member of A is a part of x , and every part of x overlaps some member of A .)

For example, a sum of the set {the Eiffel Tower, JVC's nose} would be an entity that has each of the members of that set as parts and each of whose parts overlaps either the Eiffel Tower or JVC's nose. (Why don't we express the second clause of the definiens more simply by saying that every part of x is a member of A ? The answer is that we wish to count as parts of the sum such things as the rivets and beams in the Eiffel Tower, which

² For a survey of various systems with references, see Peter Simons, *Parts: A Study in Ontology* (Oxford: Oxford University Press, 1987). One presentation of Tarski's system is Alfred Tarski, "Foundations of the Geometry of Solids," in *Logic, Semantics, and Metamathematics* (Oxford: Oxford University Press, 1956), pp. 24-29. For the system of Nelson Goodman and Henry Leonard, see "The Calculus of Individuals and its Uses," *Journal of Symbolic Logic*, 5 (1940), GET PP.

are not *members* of the doubleton set {the Eiffel Tower, JVC's nose}, but which do *overlap* one of the members.)

It is possible to define the notion of a sum without presupposing the existence of sets, so long as we use some other device to similar effect, such as plural variables. Van Inwagen gives the following definition:

x is a sum of the y s =df the y s are all parts of x and every part of x overlaps at least one of the y s.³

Thus, a sum of all the pennies in the universe would be a thing of which all the pennies are parts and every part of which is (either a penny or) something overlapping a penny.⁴

Here is some alternative terminology: instead of saying that x is a sum of A (or of the y s), we could say that the various members of A (or the y s) *compose* x .⁵ If the y s have been enumerated (say as a and b), we can use the expression ' $a + b$ ' as a name for the sum of the y s.

I now proceed to Tarski's axioms, of which there are two. The first says that the relation *is part of* is transitive:

A1. If x is part of y and y is part of z , then x is part of z .

The second axiom pertains to the existence and uniqueness of sums:

A2. $\text{Ex}(x \text{ is a member of } A) \rightarrow \text{Ex}(x \text{ is a sum of } A \ \& \ (y)(y \text{ is a sum of } A \rightarrow x = y)$

This axiom says that every nonempty set has a unique sum. It will be useful to divide the import of it in two. One half (the half that employs only the first conjunct in the consequent) says that for any nonempty set of entities, there is *at least* one sum of that

³ Van Inwagen, *Material Beings*, p. 29. Van Inwagen explains plural variables and plural quantification in chapter 2. A similar device is used by David Lewis in *Parts of Classes* (Oxford: Blackwell, 1991), GET P.

⁴ The phrase in parentheses is redundant, since every penny overlaps a penny.

⁵ Some authors, like van Inwagen, prefer to use the locution 'the y s compose x ' only when there is no overlap among any of the y s. In this usage, New York City would be composed by its five boroughs, but not by the boroughs together with Central Park.

set, that is, at least one entity that the members of that set compose. The other half (the half that employs the second conjunct in the consequent) tells us that there is *at most* one such sum.

The uniqueness of sums is perhaps almost as controversial as their existence. It arguably implies that a statue and the clay of which it is made are one and the same, for they are both sums of exactly the same molecules. My main concern in what follows will be defending the existence half of the axiom, but at times I shall draw upon uniqueness as well.

There are other axiomatizations of classical mereology besides Tarski's, differing from his and from one another in what notions they take as primitive, in whether they presuppose the existence of sets, and in what principles they choose as axioms. For our purposes here, all these systems are equivalent. They all assume the same formal properties (transitivity and the like) for the part-whole relation, and they all have the same implications regarding the existence and uniqueness of sums.⁶

The view that every set has a sum, or that any objects whatsoever are parts composing a larger whole, has its mirror image in the doctrine that any objects whatsoever are wholes composed of smaller parts. The second view is a denial of the existence of

⁶ As an example, I present here an axiomatization of Leonard and Goodman's mereology due to Rolf Eberle, *Nominalistic Systems* (Dordrecht: D. Reidel, 1970). There are three axioms:

- A1. $x < y \leftrightarrow (z)(z \circ x \rightarrow z \circ y)$
 A2. $\exists x Fx \rightarrow \exists x(y)(y \circ x \leftrightarrow \exists z(Fz \& y \circ z))$
 A3. $(z)(z \circ x \leftrightarrow z \circ y) \rightarrow x = y$

A1 does the work of Tarski's first axiom, for it implies that the part-of relation is transitive. (It also implies that the relation is reflexive.) A2 and A3 together do the work of Tarski's second axiom without taking for granted the existence of sets. A2 tells us that if there any Fs, then there is something that overlaps exactly those things that overlap an F. Since 'F' could be a disjunctive predicate like 'is identical either with the moon or with the Eiffel Tower', this axiom guarantees the existence of a sum of any two or more entities. A3 secures the uniqueness of sums. If x and y are composed of the same things, whatever overlaps either will overlap the other, and A3 tells us in that case that x and y are identical. (In the consequent of A3, I have put ' $x = y$ ' where Eberle had a Leibnizian definition of it, ' $A \rightarrow A[y//x]$ '.)

mereological atoms, or simples, in favor of the view that everything has parts within parts *ad infinitum*. To believe that matter is infinitely divisible in this way is to believe in what David Lewis calls “atomless gunk.”⁷ To believe in all the sums countenanced by the classical mereologist is to believe in what I shall call (without prejudice) mereological junk. Belief in junk and belief in gunk are independent of each other, and a commitment to gunk is not part of classical mereology. Nonetheless, the two views are to some extent mutually reinforcing (as I show below), and I myself accept a package of views in mereology that includes them both. To the question “When are objects parts?” I say “Always,” and to the question “when are objects wholes?” I again say “Always.”⁸

How did it come about that modern axiomatizations of mereology all take for granted an assumption that seemingly flies in the face of common sense—that in addition to pebbles and houses and planets, there are such junky objects as the object allegedly composed of the moon and the pennies on my desk? I don’t know, unless the answer is that the assumption is not so counter-intuitive after all.⁹ For my part, when I was first asked to entertain the idea that there are such wildly scattered and gerrymandered objects, my reaction was not “How crazy!” but “Why not?” In what follows, I shall do my best to get the reader to agree.

One word before we begin about what is at issue. If you accept that there is such a parcel or aggregate of matter as that composed of the moon and the pennies, you already

⁷ David Lewis, *Parts of Classes* (Oxford: Blackwell, 1991), p. 20.

⁸ I have defended the gunk hypothesis (which is one half of Kant’s Second Antinomy) from Kant’s attempt to refute it in *Problems from Kant* (Oxford: Oxford University Press, 1999), pp. 63-65. For an argument in its favor, see Dean W. Zimmerman, “Could Extended Objects Be Made Out of Simple Parts? An Argument for ‘Atomless Gunk’,” *Philosophy and Phenomenological Research*, 56 (1996), 1-29.

⁹ Perhaps another reason is that some proponents of mereology wanted it to do some of the work of set theory, in which case a very catholic notion is needed of which objects make up wholes.

agree with me, even if you don't consider that aggregate to be very thinglike. It need not be a *thing*, in any narrow sense of the term; it need only be *there*.

2. Against real coincidence

One of my reasons for believing in mereological universalism is that it affords a solution to what is sometimes called "the paradox of coincidence" or "the explosion of reality." I shall need to sketch some background before we can appreciate this problem.

What is the ontological status of an everyday object like a desk or a snowball? Is it something over and above the matter of which it is composed? The broadly Aristotelian answer is yes: the desk is distinct from the wooden pieces from which it was assembled, and the snowball is distinct from the snow from which it was crafted. The snowball is a compound of matter and essential form.¹⁰ Its matter is a certain quantity of snow; its form is roundness together with separation from other snow. When the snow was formed into a ball, a genuinely new entity came into being. It is not identical with the snow for at least two reasons: first, the snow existed before the ball was created; second, the ball might survive the melting of some of the snow around its edges. It has an identity that transcends that of the particular matter of which it is made.

The Aristotelian position leads to a problem that Sosa has dubbed "the explosion of reality."¹¹ To be drawn into the problem, ask yourself the following question: which

¹⁰ For discussion of the snowball as a paradigm composite of form and matter, see Ernest Sosa, "Subjects Among Other Things," in *Philosophical Perspectives*, Volume I, edited by James Tomberlin (Atascadero, CA: Ridgeview Publishing Co., 1987), pp. 155-87.

¹¹ Ernest Sosa, "Putnam's Pragmatic Realism," *The Journal of Philosophy*, 90 (1993), 605-26. The key section of this article for present purposes, "Nonabsolute Existence and Conceptual Relativity," is reprinted along with an addendum in *Metaphysics: The Big Questions*, edited by Peter van Inwagen and Dean Zimmerman (Oxford: Blackwell, 1998), pp. 399-410. I have developed the explosion problem independently in "Mereological Essentialism, Mereological Conjunctivism, and Identity Through Time," *Midwest Studies in Philosophy*, 11 (1986), 141-56.

aggregates of matter and which forms are such that when those aggregates come to exemplify those forms, a new entity is thereby created? It seems to me that an impartial Aristotelian ought to answer as follows: whenever *any* matter instantiates *any* form, a new entity thereby exists. Consider, for example, the entity Sosa calls a *snowdiscall*, which has its matter a chunk of snow and as its form any shape between being round and being disc-shaped. If you take a snowball and flatten it, you destroy the snowball (having deprived it of its essential form), but you leave a snowdiscall in its place. Moreover, the snowdiscall you leave was there all along, sharing matter with the original snowball. Our own conceptual scheme may not recognize snowdiscalls, but that seems to be just a parochial failure to acknowledge entities that are ontologically on a par with snowballs.

From here it is but a short step to the recognition that an impartial Aristotelian (or “absolutist” as Sosa calls him) should admit that there are millions of entities inhering in any parcel of matter. Consider the following series of shapes: being round, being round or flattened up to degree 1, being round or flattened up to degree 2, and so on, until we reach the property of being round or flattened up to some degree including being squashed into a disc. We may distinguish infinitely many such shapes. From an impartial or absolute point of view, each of these shapes has as much claim as roundness to be regarded as the essential form of an entity of some type. An ordinary snowball, it would therefore seem, coincides with infinitely many other entities—snowdiscalls of all possible degrees.

Some may resist this result because they boggle at the sheer number of entities involved. I resist it myself because the entities involved would all share exactly the same place and exactly the same matter, thus violating two plausible philosophical principles:

“Two or more things cannot be in the same place at the same time” and “There cannot be difference of entities without difference of content.”¹²

How are we to avoid the endless proliferation of entities sharing exactly the same place and matter?¹³ One way would be to eschew the Aristotelian line in favor of a logical atomist or eliminativist line. The eliminativist says that composite entities are really fictions or logical constructions. To say that a table exists is just shorthand for saying that some wooden legs and a top have been fastened together; it is not to posit any new entity in addition to the parts. Similarly, to say that a snowball exists is just to say that some snow has been formed into a ball. We don't get the myriads of entities the absolutist recognizes because we don't even get as far as the table and the snowball. It is correct to say, of course, that there is a snowball in my hand, just as it is correct to say that the sun is now setting; but in either case, the truth underlying what it is correct to say is something different. Yes, the sun is setting, but that is simply to say that the earth is rotating so that the sun is disappearing from view. Yes, there is a snowball in my hand, but that is simply to say that some snow has been scooped up, made round, and placed in my hand. More generally, any statement asserting the existence of a composite entity or predicating something of it must be mere shorthand for some statement telling us how certain basic entities are configured.

¹² The first principle is often advanced under the name “the impenetrability of matter.” The second is advanced by Nelson Goodman, *The Structure of Appearance* (Indianapolis, IN: Bobbs-Merrill, 1966; 2d edition), p. 36.

¹³ Ted Sider devotes a chapter of *Four-Dimensionalism* (Oxford: Oxford University Press, 2001) to “The Paradoxes of Coincidence,” canvassing many more strategies than I consider here for avoiding the result that distinct objects can share the same parts and occupy the same location. The fact that such a plethora of strategies has been developed shows the extent and depth (at least among philosophers) of the intuition that real coincidence is something to be avoided if possible.

The trouble for such eliminativism is that it does not go well with the possibility that perhaps there *are* no basic or simple entities.¹⁴ As was said above, I am inclined to believe that all is gunk—that every entity has smaller parts, and that we never bottom out with the simple. If this is so much as possible, trouble arises for the eliminativist in the form of the following argument:

1. Composite entities are (of necessity) *facons de parler*: to say that a composite exists is merely to say that its elements are arranged in a certain way.
2. It is possible that there are no simples--that is, that everything is composite.
3. Therefore, it is possible that everything that exists is a *facon de parler*.

The conclusion I take to be absurd--it cannot be that everything is a merely nominal existent. As a believer in the possibility of gunk, I reject Leibniz's maxim "if there are compounds, there must be simples," but I accept in its place "if there are nominal existents, there must be real existents."

We now have two problematic alternatives before us—unbridled Aristotelianism, which involves the incredible explosion of reality, and thoroughgoing eliminativism, which threatens to give us fictions unfounded in any facts. How are we to navigate between these extremes?

Sosa proposes to do so by espousing a view he calls *conceptual relativism*.¹⁵ In his view, ascriptions of existence are always relative to conceptual schemes. What exists relative to one scheme may not exist relative to another, and nothing can be said to exist apart from all schemes. In order for an entity to exist relative to a scheme, the scheme must recognize the essential form of that entity as one of the approved forms whose

¹⁴ As noted by Sosa in "Putnam's Pragmatic Realism."

¹⁵ Ibid.

union with appropriate matter generates a new object. The explosion is blocked, in Sosa's view, because we are not forced to say (and are indeed forbidden to say) that all the entities in the exploded universe exist absolutely speaking. Various of them exist relative to one or another scheme, but no scheme is privileged in a way that would enable us to say that the entities it recognizes are the entities that exist, period.

I have the following misgiving about the conceptual relativist's way out.¹⁶ Is not absolutism itself one possible scheme? We abjured absolutism because it leads to an incredible explosion. But then shouldn't we also abjure any scheme that embraces absolutism? Yet that would go against the spirit of conceptual relativism, if conceptual relativism holds that all schemes are on a par. To put this question another way, how does conceptual relativism avoid the explosion if it bestows its blessing equally on all schemes, including schemes that set off the explosion? And at the other extreme, how does it avoid the absurdities of eliminativism if it countenances eliminativism as a possible scheme as well?

I prefer a route between Scylla and Charybdis that draws on the principles of classical mereology. As for Scylla (the explosion), classical mereology does admittedly involve an expansive proliferation of entities (for any n given initially, at least $2^n - 1$ altogether),¹⁷ but it is more like a controlled nuclear reaction than an atomic blast. Moreover, classical mereology does not involve what seems to me the really serious objection to absolutism, namely, that it implies the existence of indefinitely many distinct entities sharing the same space and consisting of exactly the same matter as any given entity. This is because of the uniqueness axiom of classical mereology: if entities x and y have all the same

¹⁶ For further discussion, see my "On What There is Now: Sosa on Two Forms of Relativity," in *Philosophers and Their Critics: Ernest Sosa*, edited by John Greco.

¹⁷ If there are three atoms, a , b , and c , there will be seven entities altogether: a , b , c , $a + b$, $b + c$, $a + c$, and $a + b + c$. If a , b , and c have their own parts, there will be many more entities altogether.

parts (at some level of decomposition), they are really one and the same. You cannot have two entities, such as a snowball and a snowdiscall, that are composed of exactly the same H₂O molecules. For a given region of space, there will be at most one entity that exactly fills it, and for a given tract of matter, there will be just one entity that is composed of exactly the matter in that tract.

Our Charybdis was the threat of total nihilism if we go eliminativist. For what if there are no simple or ultimate parts of matter? If all composite entities are merely nominal existents, it would then follow that everything is a merely nominal existent, which is absurd. But as a classical mereologist, I need not hold that *all* composites have merely nominal existence; I need only hold that composites of matter *and essential form* have nominal existence. Mereological sums are composite entities that are not constituted by any essential form--as far as their existence is concerned, nothing matters but their matter. Or, if you prefer, you could say that mereological sums are entities whose essential form is nothing more than the co-existence of the relevant parts. In any case, as sheer aggregates of matter, they exist just so long as their parts exist, no matter how radically rearranged, finely chopped, or widely scattered. So even if there are parts within parts all the way down, the threat of nihilism is averted. You can safely believe in gunk if you also believe in junk.

Here, then, is one philosophical advantage of classical mereology: it is one way of simultaneously avoiding the excesses of unbridled Aristotelianism and the austerities of thoroughgoing eliminativism.

3. Against arbitrariness and indeterminacy

Universalism is one answer to what van Inwagen calls the Special Composition Question: when do a number of objects form a whole? Or, as he states it using plural variables, when is there an object y such that the x s compose y ?¹⁸ There are two extreme answers to this question: *always*, which is the answer given by universalists, and *never*, which is the answer given by the philosophers van Inwagen calls nihilists.¹⁹ There are also various moderate or in-between answers, which give the answer ‘sometimes, but not always’. In this section, I shall argue for universalism by elimination, exposing problems with nihilism and with all the likely in-between answers.

I can be brief with nihilism. Nihilism says that no objects ever compose a whole—that there are no composite objects in the universe, but only mereological simples. There are no such things, then, as the Washington Monument or Clinton’s desk or even a molecule of H_2O . That sounds drastic, but the force of the doctrine is mitigated somewhat if we accord a kind of nominal existence to composite objects. There are no desks, but there are atoms arranged desk-wise; no water molecules, but atoms of hydrogen and oxygen arranged H_2O -wise, and so on. The reader will recognize nihilism as a very close relative of the eliminativism discussed in the previous section.²⁰

It is close enough, indeed, to be subject to the same difficulty. Isn’t it a possibility that there are no atoms, that all is gunk? If so, nihilism becomes worthy of its name: it

¹⁸ *Material Beings*, pp. 30-31. Van Inwagen distinguishes this from the General Composition Question, which seeks an equivalent to ‘the x s compose y ’ with the variable ‘ y ’ free. For subtle reasons detailed in chapter 4, he thinks the General Composition Question is much more difficult to answer than the Special Composition Question.

¹⁹ Actually, van Inwagen’s nihilist says that there is never a y that the x s compose unless there is only one of the x s—the degenerate case of a thing composing itself.

²⁰ Both doctrines imply that there are no composite objects, but they are not quite equivalent. One difference is that thoroughgoing eliminativism implies that there are no objects consisting of a single atom exemplifying a monadic form, while nihilism is silent on this point.

implies not just that there are no composite objects, but that there are no objects whatsoever that really exist. For this reason, I reject it.²¹

On then, to the moderate answers, which hold that composition sometimes occurs, but not always—it is subject to restrictions.

If composition is restricted, it must presumably be restricted by some principle. The principle will look like this: the *x*s compose something iff the *x*s stand to one another in relation *R*. But what would the principle be? The most obvious candidates are all open to criticism. Either they fail to gibe with the ordinary judgments they are supposed to codify, or they incur objectionable arbitrariness or vagueness, or both.

One restriction might be this: objects that compose something must exactly occupy some continuous region of space. Perhaps equivalently, they must be in contact: any two of them must either be in contact with each other or connected by a chain of contact relations running among the rest of them. That would rule out many of the more bizarre mereological sums, such as the sum of the Eiffel Tower and my nose. But it would also rule out many things that common sense probably wishes to rule in: the land mass of the state of Michigan, tokens of the letter ‘i’, and, if physics is to be believed, almost all of the familiar objects around us. Even such a paradigm of continuity as my desk is really a scattered swarm of subatomic particles, separated from one another by comparatively vast distances.

Unless supplemented by some other principle, the continuity principle would also rule in many things that common sense would prefer to rule out. Although tower + nose is ruled out (because disconnected), tower + nose + corridor of connecting air is ruled in—

²¹ Ted Sider also raises this difficulty for nihilism in “Van Inwagen and the Possibility of Gunk,” *Analysis*, 53 (1993), 285-89.

that object does occupy a continuous region of space.²² If it is to be ruled out in the end, it must be because some other principle disqualifies the corridor of air as an eligible connecting part.²³

Another principle that doubtless plays a role in everyday thought is that objects compose a whole if and only if they exhibit some degree of dynamical interconnectedness. This might be spelled out in various ways—for example, by saying that not many forces would separate the objects, or that they tend to move together as a unit. When I wiggle my nose, nothing much happens to the Eiffel Tower, but when I move the north end of my car into the garage, the south end usually comes along with it. This principle might (or might not) be understood liberally enough so that the sun and the nine planets of our solar system, which tend to move together through the cosmos, compose an object.

The cohesion principle (as we may call it) does not tally any better than the contact principle with common-sense judgments about when objects make up a whole. A house built of carefully piled stones probably qualifies as a genuine whole for common sense, even though one can move many of the stones without moving the rest of the house. Conversely, a mother cow and her newborn calf may move about together and exhibit a considerable degree of reluctance to be separated from one another without thereby being regarded as a whole.²⁴

The two principles considered so far—that objects are parts of the same whole when they are in contact and when they move together in harness or share a common fate—are

²² I revert to the pretense that tower, nose, and air are themselves continuous.

²³ For further objections to the principle of continuity or contact, see van Inwagen, chapter 3. For example, it would imply that a new thing comes into being when you and I shake hands.

²⁴ The example is Ned Markosian's in "Brutal Composition," *Philosophical Studies*, 92 (1998), 211-49.

attributed to infants by some psychologists.²⁵ I must therefore be a very backward scholar, for it seems that I no longer recognize principles that were familiar to me before I was out of my cradle.

The principles of cohesion and contact are open to another criticism that has more general force, applying, as I suspect, to nearly any plausible moderate principle that the reader is likely to formulate.²⁶ It is this: if a principle invokes a relation whose holding is a matter of degree, then the principle is going to give rise either to objectionable arbitrariness or to objectionable vagueness.²⁷ There will be objectionable arbitrariness if some minute degree of cohesiveness (or whatever) makes the difference between forming a whole and not, and there will be objectionable vagueness if it is indeterminate at which point along some continuum of cohesiveness a new whole comes into being.

The objection I am raising has been elaborated by Ted Sider in a form I will call the “Sider sorites.”²⁸ There are three premises and a conclusion:

- P1. If in some cases composition occurs and in others cases it does not, then there are cases in which composition occurs that are connected by a continuous series with cases in which composition does not occur.

²⁵ Susan Carey and Elizabeth Spelke, “Domain-Specific Knowledge and Conceptual Change,” in *Mapping the Mind: Domain Specificity in Cognition and Culture* (Cambridge: Cambridge University Press, 1994), pp. 169-200. The authors find these principles (which they call the principles of contact and cohesion) guiding the reasoning even of four-month old infants. For example, an infant who sees two dumbbell heads moving together will be surprised when a screen obscuring the space between the heads is removed to reveal no connecting handle. This is supposed to show that the infant believes that if objects move together (cohesion), they are parts of one object, and if they are parts of one object, they are not separated by any gap (contact).

²⁶ Actually, if the contact principle is understood strictly so that contact is not a matter of degree, it will not be open to the objection I am about to raise. It will, however, remain open to the objection that many of the objects recognized by common sense are composed of parts that are not in strict contact.

²⁷ In “Mereological Essentialism, Mereological Conjunctivism, and Identity Through Time,” I voiced the complaint thus: “I doubt that we can find any principle for doing this [admitting just the wholes that common sense normally admits] that is not either vague, arbitrary, or a matter of degree” (p. 145). I should perhaps have subordinated the first two disjuncts to the third: because the unity-making relations invoked in the principles are matters of degree, the principles will give rise either to arbitrariness or to vagueness.

²⁸ Theodore Sider, *Four-Dimensionalism* (Oxford: Clarendon Press, 2001), pp. 121-32. I have adapted Sider’s argument so that its conclusion is a disjunction—either universalism or nihilism—rather than universalism outright.

- P2. There is no sharp cut-off point in any such series. That is, there is no pair of adjacent cases such that composition (definitely) occurs in one and (definitely) does not occur in the other.
- P3. It is always determinate whether composition occurs. That is, in every case, either composition (definitely) occurs or it (definitely) does not occur.

Conclusion: Either composition always occurs or it never occurs.

The argument is in effect an argument excluding all the moderate positions and forcing us to choose between the extremes. If we have already rejected the nihilist extreme, we are then left with universalism as the only game in town.

To see how Sider's conclusion follows from the premises, it may be useful to consider another instance of the same logical pattern in which we substitute 'baldness' for 'composition' to obtain a classical sorites.²⁹ The first premise then tells us that if baldness occurs on some heads but not others, then there are pairs of heads, one bald and the other not, between which there extends a continuous series of heads differing only slightly, say by one hair each. Of course, the heads need not lie next to each other along any spatial path, nor need the series be continuous in the mathematical sense implying that between any two heads there is a third. Sider's idea is just that we can construct a series in which adjacent members are as similar as we like in whatever respect is deemed relevant to the occurrence of baldness or composition. The second premise now tells us that a single hair never makes the difference between being bald and not being bald. The third premise tells us that every head must be either bald or not bald—*tertium non datur*. Sider

²⁹ The term 'sorites' is sometimes used broadly as a name for a chain of reasoning in which each intermediate conclusion is used as a premise to generate the next conclusion. It is also used more narrowly for instances of such reasoning involving vague predicates like 'is bald' and 'is a heap'. 'Soros' is the Greek word for 'heap'.

actually says “definitely bald or definitely not bald,” but these words, it seems to me, add nothing but emphasis.³⁰

To extract our conclusion, note that P2 and P3 imply that the consequent of P1 is false. Suppose such a series of heads as P1 describes. The first head is bald; what about the second? It cannot be nonbald, or we would get a sharp cut-off, contrary to P2. Nor can it be indeterminate as to baldness or nonbaldness, or we would violate P3. It must therefore be bald. We can repeat this reasoning for each successive head, proving eventually that the last head is bald, but that contradicts the description of the series. The antecedent of P1 must therefore be false, which is to say that the conclusion is true.

To illustrate what happens when we switch from baldness back to composition, imagine a hook, a line, and a pole that I buy in order to make a fishing rod. When the three components lie in separate bins at the hardware store, they do not (according to likely moderate principles) compose any further object. Side by side on my workbench, they still do not compose a new object. When the line is tied tightly enough around the hook at one end and the pole at the other, they *do* compose a new object. But what happens before the knots are tight? What if the diameter of the knots is several times that of the pole, so that lifting the pole leaves the line behind? What if the diameter is now one millimeter less? You get the idea: to avoid objectionable arbitrariness or indeterminacy, we must say that the three components *always* composed a further thing. (Of course, I am not saying that they always composed a fishing rod).

In the baldness version of the sorites, most will find the conclusion (that baldness occurs in all cases or none) absurd. They will therefore try to find a false premise. A

³⁰ ‘Definitely F’ and ‘F’ are arguably equivalent. Whatever is definitely F is F, and as for the converse, can there be anything that is F but not definitely so? We do not need to rely on this argument, however, for the original sorites reaches its conclusion just as well if ‘F occurs or F does not occur’ is substituted for ‘F definitely occurs or F definitely does not occur’ in P2 and P3.

commonly fingered culprit is P3: with vague predicates like ‘bald’, it may be said, we do get indeterminacy. There is a range of heads in the series that are neither bald nor not bald, and our sorites reasoning cannot traverse this region of indeterminacy.

That may be a good response to the baldness sorites,³¹ but the parallel response is *not* a good response to the Sider sorites. We cannot treat composition on the model of baldness. The reason has been forcefully stated by David Lewis in a well-known passage:

The only intelligible account of vagueness locates it in our thought and language. The reason it’s vague where the outback begins is not that there’s this thing, the outback, with imprecise borders; rather there are many things, with different borders, and nobody has been fool enough to try to enforce a choice of one of them as the official referent of the word ‘outback’. Vagueness is semantic indecision.³²

It is a consequence of this thesis (often called the linguistic theory of vagueness) that whenever vagueness gives rise to indeterminacy about whether P, that is because some term occurring in ‘P’ is vague—we haven’t made up our minds what exactly it refers to.

But then how can there be any indeterminacy about whether composition occurs? Lewis continues:

But not all of language is vague. The truth-functional connectives aren’t, for instance. Nor are the words for identity and difference, and for [mereological] overlap. Nor are the idioms of quantification, so long as they are unrestricted. How could any of these be vague? What would be the alternatives between which we haven’t chosen?

The question whether composition takes place in a given case, whether a given class does or does not have a mereological sum, can be stated in a part of language where nothing is vague. Therefore, it cannot have a vague answer.³³

³¹ Here is a reason for thinking otherwise, however: to block the argument from reaching the conclusion that the last head is bald, one must hold that somewhere along the series we pass from a head that is bald to a head with one more hair that is neither bald nor not bald, but simply indeterminate. Isn’t a sharp divide between baldness and indeterminacy as bad as the already rejected sharp divide between baldness and nonbaldness?

³² Lewis, *On the Plurality of Worlds*, p. 212.

³³ *Ibid.*

I believe Lewis's reasoning can be spelled out as follows. A correct answer to the Special Composition Question will take the form 'Ey(the xs compose y) iff the xs stand to one another in relation R.' I have suggested that any candidate for 'R' in a moderate answer will likely be vague, so that it will be vague or indeterminate whether the right-hand side of this biconditional holds, even when the xs have been perfectly delineated. In that case, it must also be vague or indeterminate whether the left-hand side holds. But how can that be? Recall that the left-hand side may be spelled out in mereological primitives thus: 'Ey(the xs are all parts of y and every part of y has a part in common with at least one of the xs)'. The only terms occurring in that formula are variables, quantifiers, the logical connective 'and', and the mereological term 'is part of'. To which of those can we trace any indeterminacy?³⁴ Which of them have we not made up our minds about?

In this regard, contrast 'is part of' with 'is bald'. If we know exactly who James is and exactly how hair is distributed on his head, it may still be uncertain and indeterminate whether he is bald, because we have never decided exactly what property 'bald' expresses. But if we know exactly what objects A and B are, how can it be indeterminate whether one is part of the other? You draw the boundaries around any two objects, and I will tell you whether one is part of the other.

With the idioms of existence and quantification, it is again hard to find a source of indeterminacy in semantic indecision. 'Everything', 'something', 'there is'—is there

³⁴ In actual instances of the formula, the plural variable 'the xs' will be replaced by a term referring to some concrete plurality of objects. We may suppose that there is nothing vague about what this term refers to, for we are investigating vagueness that arises even when the xs have been perfectly delineated.

really something here we haven't made up our minds about? As Lewis says, what would be the alternatives between which we haven't chosen?³⁵

Lewis brings out a further reason for not assimilating existence to baldness, apparently connected with the dictum that existence is not a predicate. If it is vague whether someone is bald, there is someone whom we do not know how to classify—he sort of is, sort of isn't, and we just don't know what to say. But if it is vague whether there exists something composed of the *x*s, it is not that there sort of is and sort of isn't an entity composed by the *x*s and we just don't know whether to classify this entity as existent or nonexistent. If the entity is there for us to equivocate over, it exists unequivocally. There is nothing that lies in the indeterminate zone between existing and not existing.³⁶

Sider drives home the objection about vague existence engendered by vague composition in this way: a vague restriction on composition would make it indeterminate how many concrete objects there are in the universe, but there cannot be any indeterminacy in such a question about number, since it is stateable in purely logical vocabulary.³⁷ One who is gung-ho on gunk may not complete the argument in this way, however, since a gunky universe would contain an infinite number of objects even if there were vague restrictions on composition. Nonetheless, one may object to vague existence in particular cases even if it does not affect the total count of objects.

³⁵ A loophole in the argument of the last three paragraphs has occurred to me, but I do not know how seriously to take it. Could it be that we have left nothing unsettled about the meaning of the open sentence 'x is part of y' and nothing unsettled about the quantifier 'Ey...', yet there is still indeterminacy in certain formulas constructed by putting these elements together, for example, 'Ey(x is part of y & z is part of y)'?

³⁶ Compare Lewis, pp. 212-13, and van Inwagen, p. 233. This contrast between existence and baldness may in the end be spurious, however. In his final chapter, van Inwagen shows that it depends on the inference from 'it is indefinite whether $\exists xFx$ ' to 'there is something such that it is indefinite whether *it* is *F*', and he sketches a logic in which this inference fails.

³⁷ Sider, pp. 126-30.

4. Souls and brutes

There are two in-between answers to the Special Composition Question that deserve consideration before we finally settle in favor of universalism. One is van Inwagen's view that the xs compose something if and only if their activity constitutes a life—if and only if they are “ensouled” in the old-fashioned sense that connotes a mode of organization rather than an immaterial substance. The other is the “brute composition” view of Ned Markosian, according to which it is simply a brute fact that some arrangements of objects compose things and others do not.

Let me begin by acknowledging a strong pressure pushing us away from the extremes and toward the middle. The David Lodge character Morris Zapp, a deconstructionist who had previously professed that the self is a fiction, was once jolted by the realization “I will die; therefore, I am.” Zapp's realization, coupled with the assumption what I am if I exist is some compound of particles, provides a basis for thinking that some in-between answer must be correct after all. If I am a composite object that presently exists, nihilism is false. If I am a composite object that will cease to exist upon the dispersal of its parts, universalism is false. So some in-between answer must be correct.

This is a powerful argument for a moderate answer. If it is to be resisted, it must apparently be on one of three grounds: that I don't really exist, that I won't really cease to exist, or that I am not a composite object. One who took the first option would presumably believe himself to be some sort of logical construct or nominal entity, like the particles arranged deskwise we considered above. One who took the second option would believe that he will not cease to exist upon his death, but will enjoy a Lucretian sort of immortality, no longer afflicted with consciousness but surviving as sundry

particles scattered through the biosphere. One who took the third option would believe that he is an extended physical atom or a purely psychological monad. I leave the weighing of these options to the reader.³⁸

Van Inwagen rejects all three options. He thinks that he and you and I are all composite objects. So what is special about the things making us up, but not about just any old things, that lets them compose something? Van Inwagen's answer is *life*: there is something that the xs compose iff the activity of the xs constitutes a life.³⁹ In his view, living organisms are the only composite objects. If the xs are ever to amount to anything, they need to get a life.

As van Inwagen is at pains to acknowledge, it is often a vague matter whether the activity of a group of particles constitutes a life. There may be no definite point at which the activity of the cells in a growing embryonic mass comes to constitute a life, or at which the activity of a fatally damaged brain ceases to constitute a life. There may be no definite answer as to whether the activities associated with viruses and mitochondria ever

³⁸ There is also an important but hard-to-classify fourth option that we should consider. In this option, we deny the premise that says 'if I am a composite object that will cease to exist upon the dispersal of its parts, universalism must be false.' We argue that this premise is false because 'universalism is true & I am a composite object & I will cease to exist upon the dispersal of my parts' is a possible combination. Let universalism be true (every set has a sum) and let me be a composite object in the sense that there is a certain set of objects of which I am a sum. It could still be true that I will cease to exist upon the dispersal of the parts in that set. Of course, a sum of those parts will still exist after their dispersal, but I am not and never was identical with that sum, even though I was formerly composed of the very parts that compose it. I was another sum, with essential properties (consciousness or life, perhaps) not possessed by the sum that continues to exist. Plainly, this view rejects the uniqueness axiom of classical mereology.

In this view, some composite objects are "mere" mereological sums, while others are *supersums*: they satisfy the definition of a sum, but they also have persistence conditions or essential forms that go beyond those of a mere sum. Uniqueness is violated because a mere sum and a supersum may be sums of the same parts.

How shall we classify this view? It subscribes to the letter of universalism, but also has an air of moderation about it. We can raise something like the Special Composition Question all over again: when do the xs compose a supersum? If the answer is "only when their activity constitutes a life," then we are giving an answer that savors of moderation.

I believe that a position along these lines is the intended view of those who say that they wish to distinguish the 'is' of composition from the 'is' of identity. I am composed of the particles in a certain sum, they say, but I am not identical with that sum. They do not always realize that for better or for worse, they are renouncing uniqueness.

³⁹ *Material Beings*, p. 82.

constitute a life. On van Inwagen's view, then, composition is governed by a vague restriction. His view therefore incurs the objection of the previous section against theories that make it a vague matter whether composition occurs: they countenance a variety of vagueness that infects existence itself and cannot be traced to any terms whose meanings we have never made precise. In response, van Inwagen mounts a sustained challenge to the linguistic theory of vagueness.⁴⁰ I cannot hope to resolve that issue here, but must simply flag it as one of the issues on which the present issue turns.

The other in-between answer I want to consider is that of Ned Markosian. In my objections above to moderate views, I took for granted that if composition is restricted, it must be restricted by some principle. That is precisely the assumption Markosian challenges. He advocates a position according to which some objects compose wholes, others do not, and there is no saying why. They just do or do not, as the case may be, and their no deeper fact in virtue of which they do or do not. That certain objects compose wholes and others do not is simply a brute fact.⁴¹

I cannot fault Markosian for his repudiation of principle, since in some matters, I myself am a man of no principle. Consider identity through time. If object A existing today is identical with object B that existed yesterday or last year, must there be some deeper fact in virtue of which that identity obtains? Not always. Imagine a perfectly homogeneous red jelly filling an infinite green pipe, perhaps moving through the pipe or perhaps remaining at rest.⁴² If the jelly moves during the interval from t_1 to t_2 , then the portion of jelly in a certain segment s_2 at t_2 is identical with the portion of jelly in the

⁴⁰ *Material Beings*, chapters 17-19.

⁴¹ "Brutal Composition," cited above.

⁴² This example is a variant on the example of the rotating disk discussed by Kripke and others. For further discussion and references, see Sider, *Four-Dimensionalism*, pp. 224-36.

neighboring segment s_1 at t_1 . But what deeper facts does this identity fact derive from? None that are not themselves identity facts, for example, the fact that each of molecules composing the jelly in s_2 at t_2 is identical with one of the molecules composing the jelly in s_1 at t_1 . I believe there are bound to be identity facts that do not hold in virtue of any further facts that are not themselves identity facts.⁴³

Markosian's view enables him to sidestep the objections I raised to moderate views in the preceding section. I objected to certain obvious principles (of contact, cohesion, and the like) on the ground that they are either too strict or too lax to underwrite ordinary judgments about composition, and I intimated that a similar fate would befall any other moderate principles. Markosian can accept this in stride; it is part of his reason for declaring that no satisfactory principles governing composition are to be had. I also raised the objection that if composition is restricted, we can avoid objectionable indeterminacy only at the cost of objectionable arbitrariness, as shown in the Sider sorites. Markosian has a neat way around the sorites—he can say that there is nothing objectionable about sharp cut-off points between cases of composition and cases of noncomposition. Consider a parallel he offers: we could line up a thousand individuals ranging in height from one meter to two meters in one-millimeter increments, the shorter 500 all left-handed and the taller 500 all right-handed. In this series there would be only a one-millimeter difference in height between the last of the lefties and the first of the righties. No problem, though, for who said height had anything to do with handedness? There is similarly no problem in a series where a minute difference in degree of cohesion (or whatnot) separates the cases where composition occurs from those in which it does

⁴³ Markosian says that his brutal composition view is compatible with the following supervenience thesis: worlds alike in their distribution of universals are alike in their compositional facts. It may be that the jelly-and-pipe example shows that identity facts are not even supervenient in this sense.

not, for Markosian does not claim that cohesion or anything else is that in virtue of which composition obtains. Things would be otherwise for someone who thought cohesion was relevant and had either to specify an exact degree of it or leave matters indeterminate.

Markosian's position is respectable and not easily refutable, but I have two qualms about it. First, although the view is advanced in defense of common sense, it is not entirely friendly to common sense. The person on the street probably believes not only (i) that the beams and rivets of the Eiffel Tower compose an object while the Tower and the moon do not, but also (ii) that he has some idea why this is so, having to do with contact, cohesiveness, or the like. Markosian's view that composition is brute is consistent with point (i) but undermines point (ii). Second, although the view does not incur the same charge of arbitrariness as do intuitive principles of composition, it seems nonetheless to involve its own brand of arbitrariness. To see this, consider an analog of the brute composition view that might be advanced to solve the "explosion" problem of section 3. The problem was this: how can we admit that some objects are new entities over and above the matter of which they are composed without admitting that there are millions of objects co-inhabiting any lump of matter?⁴⁴ A believer in brute compounds of matter and form could deal with the problem by saying that only a few of all those millions exist, and it is a brute matter which. Perhaps when snow is formed into a ball, a new entity, a snowball, comes into being, but when snow is formed into a disk or an ellipsoid or an irregular lump, no new entity comes into being—the snow just becomes

⁴⁴ Note that the existence principles of the Aristotelian go far beyond any composition principles—even the universalist's unrestricted composition principle. The unbridled Aristotelian believes not only that any xs compose something, but also that any xs compose indefinitely many things. The moon and the six pennies may compose not only their mereological sum, but also the configuration known as a full Monty, which exists just when the moon is full and the pennies all lie tails up. When we turn a penny over, we destroy the Monty but not the sum. Since these entities are distinct despite having the same parts, the Aristotelian implicitly rejects the uniqueness axiom of classical mereology.

differently shaped. Why is that? It just is. I find that possibility pretty hard to swallow, and brutal composition does not go down any easier.

5. Question or pseudo-question?

I expect that some readers of this essay will be impatient with the entire issue. Is there or is there not an object composed of the pencil on my desk and the mug on the cabinet ten feet away? It makes no difference, these readers will say—there is really nothing here to argue about. I wish to close by discussing two grounds on which it might be urged that our question is a pseudo-question: that no empirical evidence or conceptual considerations will settle who is right, and that the difference between the two sides is merely verbal.

Gideon Rosen and Cian Dorr point out that the issue separating universalists and their opponents is neither straightforwardly empirical nor straightforwardly conceptual.⁴⁵ The issue is not straightforwardly empirical, for we cannot settle it simply by looking around or performing a test in a laboratory. Regardless of which side is right, the course of our experience will be the same. Nor is the issue straightforwardly conceptual, for we cannot settle it by an analysis of the meaning of ‘part’ (or other relevant terms) that shows the thesis propounded by one side to be analytic (and the opposed thesis therefore contradictory).

From this circumstance, the positivists of an older generation would have concluded that there is no genuine issue. If a thesis and an alleged rival of it are both consistent (so neither is analytic) and if they both tally equally well with the totality of observational

⁴⁵Gideon Rosen and Cian Dorr, “Composition as Fiction,” in *TITLE*, edited by Richard M. Gale (Oxford: Blackwell, 2002), pp. 151-74. See also what Hilary Putnam has to say about the differences between the universalist (personified by “the Polish logician”) and the atoms-only theorist (personified by Carnap) in *The Many Faces of Realism* (La Salle, Ill.: Open Court, 1987), pp. 18-19.

data, then it cannot be the case that one of them is true and the other false. Perhaps both of them are true--both really say the same thing despite differences in verbal formulation. (That is what Reichenbach said about rival systems of geometry-cum-physics, such as Euclidean geometry coupled with a complex physics and non-Euclidean geometry coupled with a simple physics.) Perhaps neither of them is true—both are meaningless verbiage in so far as they go beyond what is supported by empirical data. (That is what Ayer said about the dispute between those who affirm and those who deny the existence of a transcendent God.) Either way, it is not the case that one thesis is true and its apparent rival false; there is nothing to debate about.

Positivism of that sort is no longer in vogue, and no wonder. What is the status of its leading principle--that nothing is true unless it is either true on conceptual grounds or better supported than its rivals by the totality of observational data? As critics have often pointed out, the positivist's principle fails to measure up to its own standards. What empirical or conceptual considerations establish the positivist's own thesis, or at least give it an edge over the competing theses of metaphysical realists? None have ever been brought forth, and I doubt that any could be. The principle is therefore self-refuting, and cannot be used to discredit mereological debates.

Eli Hirsch takes the dispute among universalists, nihilists, and common-sense moderates to be a paradigm of a merely verbal dispute.⁴⁶ In a dispute of this sort, there is a disputed sentence D and there are two undisputed sentences U1 and U2 such that everyone can agree that D is true if it means the same as U1 and everyone can agree that D is false if it means the same as U2. Moreover, one side is most charitably interpreted

⁴⁶ Eli Hirsch, "Physical-Object Ontology, Verbal Disputes, and Common Sense," *Philosophy and Phenomenological Research*, 70, 2005, 1-30, especially p. 16.

as meaning U1 by the disputed sentence and the other as meaning U2.⁴⁷ In the case at hand, one of the disputed sentences is ‘There is an object x such that x is composed of the pencil on my desk and the mug on the cabinet.’ Hirsch would say that everyone can agree that this is true if it means what he takes universalists to mean by it, namely, U1: there is a pencil on my desk, *and* there is a mug on the cabinet. Everyone can also agree that it is false if it means what he takes foes of universalism to mean by it, namely, U2: there is a *mass of matter* composed of the pencil on my desk and the mug on the cabinet. The only issue, Hirsch thinks, is whether U1 or U2 is what the disputed sentence means in English.⁴⁸

For my part, I cannot see that the dispute is so easily shown to be verbal. To begin with, it is not obvious to me that U2 is false, for it is not clear to me that phrases like ‘mass of matter’ or ‘portion of matter’ in English do not apply to spatially disconnected objects. More seriously, I do not believe that U1, the supposedly charitable interpretation of the universalist’s claim offered by Hirsch, is all I mean by D. I realize that unconverted members of my audience already assent to that much, and I am trying to convince them of something more. The something more, though *entailed* by U1 if I am right, is not merely an analytical or by-virtue-of-meaning consequence of it. Perhaps my

⁴⁷ The textbook example of a verbal dispute and its resolution was provided by William James in his report on a camping trip (quoted in Irving Copi, *Introduction to Logic* (New York: Macmillan, 1978; 5th edition), pp. 127-78). One of the campers circled a tree in an effort to get a glimpse of a squirrel that was clinging to the trunk on the other side and always managing to keep the trunk between himself and his pursuer. A metaphysical dispute broke out among the rest of the campers: did the man go around the squirrel or not? Yes, James offered, if “going around” means being successively to the north, east, south, and west of him; no, if it means being successively to the front, left, rear, and right of him. James noted that most of the campers were satisfied with his solution, though some found it an evasion of the issue. Hirsch assimilates many disputes about the ontology of physical objects, such as the dispute between universalists and their opponents, to James’s incident.

⁴⁸ Hirsch actually applies this strategy to the dispute over *temporal* sums, such as the “first wood, then ceramic” object composed of the present temporal part of my pencil and a later temporal part of the mug, but one might apply it as well to the dispute over spatial sums of contemporaneous objects.

arguments in this essay have fallen short of establishing universalism, but if so, that at least shows that there was something that needed to be established. Universalism is not merely a restatement of the obvious.