

The Ontology of Events

I. Introduction

Consider the most recent Yale-Harvard football game, an event which occurred on 11/20/21 in New Haven, lasting about three hours. This event, like many college football games before, was composed of four quarters, each of which was composed of possessions, each of which was composed of downs, each of which was composed of particular movements, tackles and decisions of the individual players. Each of these parts of the game was itself an event, occurring in a smaller region of space and time than the game itself. Each of these events involved material objects like players, helmets, jerseys, etc. Each had causes and effects, and each instantiated qualitative properties, such as being a kickoff or being a tackle. These are paradigmatic examples of events. Events are many and varied; some other examples include the melting of an ice cube, the birth of a horse, the supernova of a star, the presidential election campaign and a winter snowstorm. Each of these took place in a certain region of spacetime, had other events as parts, involved certain objects, had causes and effects, and instantiated properties.

Objects and their properties are not the only furniture in the world. Events are a crucial part of our manifest and scientific pictures of the world. We go to football games, think about and participate in elections, eagerly anticipate the birth of a child, and quantify over and explain such things in our scientific theories. Yet, events have received insufficient attention from metaphysicians. Some philosophers have been skeptical of events, holding that talk of events can be paraphrased away, or that events can be reduced to objects and properties.¹ When philosophers have accepted events, their motivations have usually been extrinsic—events are introduced in order to play a role in a larger philosophical system. This tendency has led philosophers to miss a number of interesting features of events. In this paper, I wish to reverse that trend by developing an ontology of events which is not an afterthought with respect to another philosophical project. In so doing, I will provide answers to substantive metaphysical questions about the relations in which events stand and their identity conditions. In the next section, I identify four basic relations in which events stand: parthood, involvement, causation and instantiation, focusing in particular on involvement. Then, I argue that events are individuated by their involvements, and criticize the identity conditions which have been offered by other philosophers, notably Quine, Davidson and Kim. I then conclude.

¹ Van Inwagen (ms, 11-15).

II. The Basic Relations

I will introduce my ontology of events by identifying four interesting relations which events can stand in with other events, and to entities of other categories. These are:

Parthood: Events stand in mereological relations with other events.

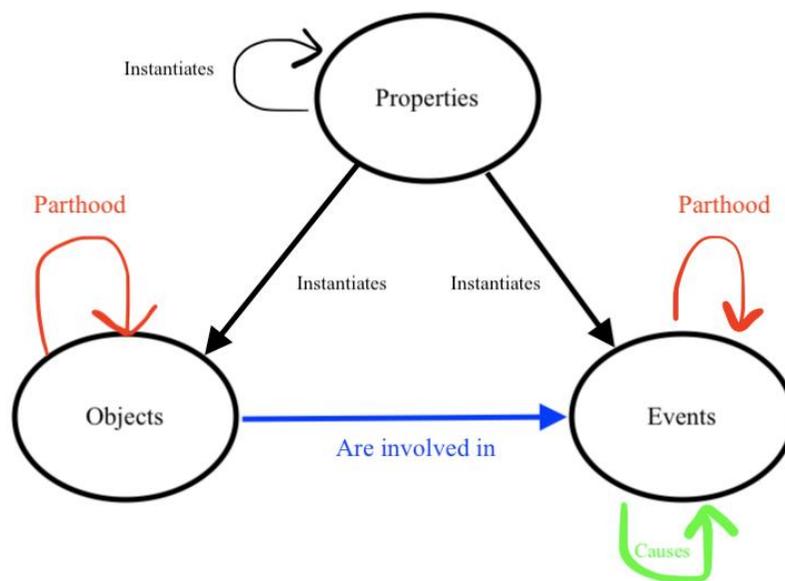
Involvement: Events involve objects.

Causation: Events are causally related to other events.

Instantiation: Events instantiate properties and stand in relations.

The first and third relations, parthood and causation, are relations that events bear to other events. Events do not have entities of other kinds as parts, nor are they part of entities of other kinds, on my view. Nor are they related by cause and effect to entities of other kinds. The second and fourth relations, involvement and instantiation, relate events to entities of other ontological categories: objects and properties, respectively. Events instantiate properties like objects do, and events involve some of the objects located where they occur.

I am conceiving of events as an ontological category, like objects and properties. Indeed, in my view, these exhaust the ontological categories. My ontology (“the three-category ontology”) is summarized in the following chart:²



² Other accounts contain a different number of fundamental ontological categories. Paul (2016) develops a one-category ontology. Van Inwagen (2014) defends a two-category ontology, while Lowe (2005) prefers a four-category ontology.

There are three categories in this picture: properties, objects and events. And there are four relations which relate the categories: parthood, involvement, causation and instantiation. As we proceed in discussing these four relations, it will become clear why we need to make room in our ontology for events, and not simply collapse the distinction between events and one of the two other categories. One way that we will see this throughout the paper is by investigating the notion of involvement and showing how, though it has not been sufficiently appreciated by philosophers, it is crucial for understanding the distinctiveness of events. Let us now start to unpack this picture.

Parthood

The first quarter of a football game is an event. It is a proper part of the whole football game. Likewise, the kickoff is a proper part of the first quarter. This section explores the mereology of events, drawing comparisons with the already well-developed mereology of objects.³ This is a substantial topic, and I cannot settle here whether all and only mereological principles governing objects also govern events. Rather, I will identify five formal properties which both mereologies obey. The first three are: parthood is reflexive, anti-symmetric and transitive. Now we need to distinguish parthood (\leq) from proper parthood (\ll): each object is a part of itself, but D is a proper part of E just in case D is part of E but E is not part of D . Second, a supplementation principle at least as strong as weak supplementation is needed to characterize the proper parthood relation. Weak supplementation is arguably part of the pretheoretical meaning of “part,” since it differentiates proper parthood from other partial orders.⁴ Finally, I will assume atomism, since non-atomic object and event mereologies raise substantial complications.⁵

At this point, it is appropriate to raise the special composition question for events (SCQE). The special composition question for objects (SCQO) asks under what conditions a collection of objects composes a further object. In other words, it is a request for an analysis of the proper parthood relation of the following form: $O_1 \ll O_2$ iff ____.⁶ There are two types of

³ For an early treatment see Leonard and Goodman (1940) and see Varzi (2019) for a recent overview.

⁴ Simons (1987, chapter 2) contains a seminal discussion of these matters, and much of what he says carries over straightforwardly to the mereology of events.

⁵ I address the question of atomism in the context of object and event mereologies in the appendix.

⁶ SCQO was first introduced by van Inwagen (1990) and has received considerable attention since.

answers to SCQO, extreme and moderate. There are two extreme answers. Universalists hold that composition always occurs: take any collection of objects, such as my nose and the Eiffel Tower, and there is a further object which they compose.⁷ Nihilists hold that composition never occurs, and that the only material objects which exist are simples.⁸ Neither extreme answer is acceptable, because there are composites like chairs and people, and not every collection of objects composes a further object: there is no Eiffel Tower-nose sum. This motivates moderate answers, on which composition sometimes occurs and sometimes does not. Van Inwagen develops a moderate answer to SCQO holding that composition occurs just when the composed entity constitutes a life.⁹ There are other moderate answers as well.¹⁰ SCQE asks the same question of events: $E1 \ll E2$ iff _____. There are extreme and moderate answers to SCQE. Like extreme answers to SCQO, extreme answers to SCQE are implausible. Nihilism implies that there are no football games, yet there are football games. Universalism implies that my recent sneeze and the construction of the Eiffel Tower compose a further event, yet there is no such event.

Thus, a Moderate answer to SCQE is the most plausible. Though I will not provide a fully worked out answer to SCQE in this paper, I will make a few remarks which should get us close to one. I will start by defending the following principle:

Parthood Implies Containment (PIC): If $E1 \ll E2$, $E1$ occurs in a region which is fully contained in the region in which $E2$ occurs.

An event could not fail to occur in a region contained by the region in which an event of which it is a part occurs. Indeed, we can see PIC as a regulative principle concerning how we identify the spatiotemporal location of an event. Here is a general strategy for responding to putative counterexamples to PIC along these lines: if we think that $E1 \ll E2$ yet the region in which $E1$ occurs is not contained in the region in which $E2$ occurs, then either (1) we have identified the wrong region for one or both of the events, and (2) $E1$ is not a proper part of $E2$ after all. PIC is a necessary condition for event composition, but its converse is not a sufficient condition.

Consider the event of a butterfly's flapping its wings on the field where the Harvard-Yale game

⁷ Leading defenses of universalism are Lewis (1991) and Leonard and Goodman (1940).

⁸ Sider (2013) argues for nihilism.

⁹ Van Inwagen (1990).

¹⁰ Markosian (1998) and Merricks (2001) develop interesting moderate answers.

is being played. This event is not part of the game. So not all events which occur inside of the region where a larger event occurs are part of that event.¹¹

What, then, is sufficient for one event's being part of another? A promising strategy can be borrowed from Trenton Merricks.¹² He argues that the only things which exist are those that have non-redundant causal properties. Though Merricks develops this idea to vindicate the existence of objects like persons and perhaps other organisms, it is more naturally applied to events, since they are the causal relata. Thus, some events compose a further event if the further event stands in causal relations distinct from those of the collection of its parts. Suppose that my drinking coffee this morning was composed of 25 sips spaced five minutes apart, and that each part was proximately caused by the immediately prior state of my brain and body. Yet, my drinking coffee, the sum of 25 sips, was not proximately caused by the prior state of my brain and body (at least in the same way as the sips were). Rather, it was caused by the desire to write a paper on events and the belief that the coffee would wake me up enough to do this! A composite event exists over and above its parts if it produces a difference in the world, or it was produced by a difference-making entity.¹³ The sum of my 25 sips of coffee do compose a distinct event for this reason, but the construction of the Eiffel Tower and my last sneeze do not compose a further event, because this event would have no causes and no effects distinct from those of the sneeze and the construction.¹⁴ This account must be worked out in greater detail to provide a rigorous and defensible sufficient condition for event composition, but these brief remarks will have to do for our purposes.¹⁵

Involvement

The Harvard and Yale teams, their players, the referees, football, jerseys, etc. are involved in the Yale-Harvard football game. All of the bits of matter in a star are involved in its

¹¹ Lewis (1986, 241-269) agrees, even giving examples of two distinct events which share the exact same region

¹² Merricks (2001).

¹³ We should not rule out epiphenomenal or uncaused events by definition, hence the disjunctive analysis.

¹⁴ Note that this is not to individuate events by their causes and effects (which I will argue against later in favor of individuating them by their involvements). Rather, it is to give *existence* conditions for events, which are distinct from *identity* conditions. I have not yet given identity conditions for events because weak supplementation alone does not ensure the uniqueness of composition, so there could be two events with the same parts which each have (perhaps the same!) causal relations distinct from those of their shared parts. This analysis also implies that if there are events which are both epiphenomenal and uncaused, then they are atomic. I think this is the right result.

¹⁵ Van Inwagen points out (1990, sect. 17) that on any moderate answer to SCQO, there will sometimes be objective indeterminacy as to whether one object is part of another. The same will hold for moderate answers to SCQE.

supernova. The protestors, signs and megaphones are involved in the protest. Such examples help one grasp the notion, but any ontology of events must move from examples to a more precise, theoretical and abstract characterization of the involvement relation, which I will provide here. Involvement is an especially interesting relation, since it is central to what it is to be an event. Unfortunately, it has been neglected by other theorists of events, which has impoverished and distorted their accounts, a fact which will become clear as we proceed.

First, every event must involve at least one object—what it is to be an event consists in involving objects. Second, no supplementation principle governs involvement. If E involves O, there need not be an object O*, disjoint from O, which E also involves. For example, changes are events and involve only the substances in which they are changes. Third, only objects can be involved in events, and objects can only be involved in events. Involvement is a dyadic, asymmetric relation holding between one object and one event.¹⁶

At this point, we can raise what might be called “The Special Involvement Question” (SIQ). This question asks for necessary and sufficient conditions for an object to be involved in an event (where “\$” is the involvement relation): $O \$ E$ iff _____. Here is the necessary condition:

Involvement Implies Containment (IIC): If $O \$ E$, then the region where O is present is contained in the region in which E occurs.

Objects which are involved in an event must be present in the region in which that event is occurring. IIC, like PIC above, should be considered a regulative ideal, helping to identify the region in which an event occurs, and there are analogous strategies for responding to counterexamples. Again, like above, the converse is not a sufficient condition. A butterfly present on the football field is not automatically involved in the football game. More generally, not every object in the region where an event is taking place is involved in that event.

Like SCQE, I cannot provide a fully worked out answer to SIQ in this essay. But I can provide a few constructive remarks. It is plausible to think that some supervenience claim relates events and the objects involved in them.¹⁷ The intrinsic properties of an event supervene on the properties of its involvements. Facts about football games supervene on facts about players, referees, uniforms, balls, etc. One who wants to reduce events to objects and properties will

¹⁶ Of course, we can define a plural notion of involvement as follows: the objects O1, O2, ... are involved in event E just in case each one of the O's is involved in E.

¹⁷ Stronger claims, like those grounding events in the objects involved in them, are in my view less plausible.

require such a supervenience claim, but even non-reductionists can accept such a supervenience thesis too.¹⁸ If a supervenience claim like this does go through, then the strategy for identifying the objects involved in an event is straightforward: all of the objects on which facts about the event supervene are involved in it. And this points to a rather liberal notion of involvement—events usually have many involvements, since the intrinsic features of an event may depend on a wide variety of objects. We will return to this point below. Though we do not have a precise sufficient condition for an object's being involved in an event, we do have the general supervenience of facts about events on facts about their involvements to guide us.

Parthood and Involvement

Now that we have parthood and involvement on the table—we can lay down axioms concerning how they relate to one another. These are:

(A1) $\forall E1, E2, O$: If $O \$ E1$ and $E1 < E2$, then $O \$ E2$.

(A2) $\forall E, O1, O2$: If $O1 < O2$ and $O2 \$ E$, then $O1 \$ E$.

(A3) $\forall E1$: If $\exists E: E \ll E1$, then $\forall O$: If $O \$ E1$, then $(\exists E: E \ll E1 \text{ and } O \$ E)$.

Together, these axioms and the formal properties of $\$$ and $<$ give an elegant picture of the structure of events, and how they relate to objects. Let us consider them individually. There are many examples that support (A1), and it is hard to see how it could fail. If (A1) failed, then we would need to explain why some of the objects involved in an events parts are involved in that event, but others are not—a substantial explanatory task. The Harvard quarterback is involved in the first quarter, so he is also involved in the Yale-Harvard game.

It may be useful for some purposes to define a stronger notion of involvement for which (A1) fails. Suppose that the Harvard quarterback gets ejected from the game for bad behavior in the second quarter, precluding his involvement in subsequent proper parts of the football game. There should be a way to say that the Harvard quarterback was not involved in the entire game, unlike, say, the well-behaved Yale quarterback who was not ejected. Our spatiotemporal mereology of events allows us to do just this. Consider the following definition:

¹⁸ This datum is supported by the epistemological priority of objects over events—if asked to locate a football game, to do this we must locate individual people, balls, uniforms, a field, etc. See further Strawson (1990, 45-51) and Davidson's discussion of Strawson in his (2001, 173-175).

Object O is *involved in the entire event* E =df object O is involved in each of a series of parts of E : E_1, E_2, \dots , such that the sum of the regions of spacetime where the events E_1, E_2, \dots occur is the same as the region of spacetime where E occurs.

The Harvard quarterback is not involved in the entire game but the Yale quarterback is, though both are involved in the game *simpliciter* in virtue of being involved in one part, by (A1).¹⁹

We might also want to define weaker notions of involvement. Consider partial involvement:²⁰

Object O is *partially involved in event* E =df $\exists O^*$: $O^* \ll O$ and $O^* \$ E$.

(By this definition and (A2), any composite object which is involved in an event is also partially involved in that event). The notion of partial involvement may be useful in some discussions of causation, and it is at our disposal by accepting $\$, \ll$, and (A1) - (A3). Thus, using the spatiotemporal mereology of events that we have developed allows us to affirm (A1), and to define other stronger or weaker notions in terms of the basic notion of involvement.

Now consider (A2). The kicker's fingernails are parts of him and the kicker is involved in the game, but does this mean that the kicker's fingernails are also involved in the game? Initial intuitions may differ on whether to say that the fingernails are involved in the game. He does not use them to do anything that effects the progress of the game, after all. It would be odd, however, to deny that *any* of the proper parts of an object involved in E are also involved in E . So, at least some of an object's parts must be involved in the events that it is involved in. If we do not hold (A2) we must answer a lot of difficult questions. For one, we must explain why some of an object's parts are involved in the events which it is involved in, and others are not, but it is difficult to see what such an "involvement maker" could consist in. Affirming (A2) sidesteps such questions and increases the elegance and simplicity of the overall theory. It allows us to capture the idea that when an object is involved in an event, all of it is involved in the event.

(A3) states that if an object is involved in an event, then it is involved in at least one proper part of that event, if that event has proper parts. It is hard to see what a counterexample to this principle would be, since events are usually decomposed into parts quite finely, finely enough to accommodate each involvement. When a person plays in a football game, he always

¹⁹ This definition has the virtue of not requiring an object involved in the entire event to be involved in every proper part of that event, since any modestly large and complex event will have no object which is involved in every part of the event. You can verify this for the football game. Some events may have no objects involved in their entirety.

²⁰ Thanks to [redacted] for a discussion of cases which lead to the need for a notion of partial involvement.

plays in some part of that game, when a snowflake falls in a massive blizzard there is the falling of the individual snowflake which is part of that blizzard, etc. There is no such thing as *sui generis* involvement in the whole event without involvement in one of the sub-events which compose it.

It follows from these axioms that any overlapping events must share an involvement.²¹ By contrast, two overinvolving events (i.e., events which share at least one involvement), even ones which take place at the same place and time, do not necessarily overlap. Example: O = a bad student E1 = metaphysics class E2 = an online game of poker. In this example, the bad student is involved in metaphysics class, and also involved in the poker game, yet these two events do not overlap. Thus, disjoint events can share an involvement. Overlap implies overinvolvement, but not vice versa. (A1) and (A3) also get us to the uniqueness of composition for events, without the need for anything stronger than weak supplementation, given (as I will argue later) that events are individuated by their involvements.²²

We now have some preliminary results on the table about how parthood and involvement interact.²³ Yet, that these are distinct relations might still be doubted. A concern for parsimony would seem to recommend reducing involvement to parthood. We should construct a composite event out of the events which are its parts and the objects involved in it using the same glue, so the objection goes.

There is something to this objection, on some theories of material objects. Four-dimensionalists believe that material objects are composed of instantaneous temporal parts, one for each moment of their careers. Four-dimensionalists are often described as (or accused of) “eventifying objects.”²⁴ The four-dimensionalist does not need events as a distinct category, for she has already the theoretical resources to do the work of events. The four-dimensionalist can analyze an event as a mereological sum of the temporal parts of the objects involved in the event which exist at the times at which the object is involved in the event. If the four-dimensionalist truly does collapse the distinction between events and objects along these lines, then it is easy

²¹ Proof: If E1 overlaps E2, then there is an event, E3, which is a part of both E1 and E2. E3 must involve at least one object, call it O. By (A1), O \$ E1 and O \$ E2. (Underlapping events do not necessarily share an involvement).

²² Proof: Suppose E and E* have the same parts E1, E2,... Let I(E) designate the set of objects involved in event E. By (A1) and (A3): $I(E) = I(E1) \cup I(E2) \cup \dots = I(E^*)$. And if two events are distinct iff they have different involvements (as I will argue below), then $E = E^*$.

²³ See the appendix for a couple more results relating to atomism.

²⁴ Casati and Varzi (2020, section 1.1), see also Goodman (1951), Quine (1970).

enough to understand how she cannot see a distinction between parthood and involvement. On the four-dimensionalist picture, there is only one kind of structural constituent of an event, its temporal parts, since there is no distinction between event and object. However, four-dimensionalism is a bad theory, for one, because it fails to recognize the clear distinction between objects and events. Pencils, snow, and babies are fundamentally different kinds of things than scribbling, blizzards, and births. Four-dimensionalists will not see a distinction between parthood and involvement because they see no distinction between objects and events. I will assume three-dimensionalism in what follows.

For the three-dimensionalist, there are a few reasons why reducing involvement to parthood will not go smoothly, if it can be done at all. First, we have seen that involvement and parthood have different formal properties: parthood obeys a supplementation principle at least as strong as weak supplementation, and involvement obeys no supplementation principle. To reduce involvement to parthood, we would have to modify the formal profile of one relation, and justify doing so on grounds independent of the desired reduction. Second, the objection is motivated by the thought that the objects which are involved in an event should be considered parts of the event. But if objects and events can stand in mereological relations, then we must either tolerate the possibility of an event's being part of an object or explain the asymmetry whereby objects can be part of events and not vice versa. The first disjunct is incompatible with three-dimensionalism. Since events have temporal parts and parthood is transitive, if objects had events as parts then they would have temporal parts, contra three-dimensionalism. The second disjunct looks like an arbitrary, brute fact, and it is hard to see what could explain this categorical asymmetry of mereological relations in a satisfying way. The simplest and best way of explaining why events cannot be parts of objects is that events cannot stand in mereological relations with objects at all.

More generally, but along these same lines, a third response would hold that parthood is an intra-categorical relation: only two things of the same ontological category may be related as part and whole. This is pictured in the figure above. If parthood were not intra-categorical, then some things of one category would be able to give rise to something of another category merely by being its parts, an unattractive view about the nature of categories. An analogous case may illuminate the difficulty. Objects bear mereological relations to the smaller objects composing them, and bear instantiation relations to the properties they exemplify. Should we try to reduce

this instantiation relation to parthood? We do not speak of objects having properties as parts, or vice versa. All philosophical doctrines on the nature of properties distinguish the relation which objects bear to their parts and the relation which they bear to their properties, except for the most extreme forms of nominalism according to which for a thing to be an F just is for it to be a part of the mereological sum of all F's.²⁵ To attempt to reduce instantiation to parthood on grounds of simplicity would be to miss the structural complexity of objects. Likewise, for reducing involvement to parthood. Events and objects are structurally complex things, and this structure derives both from the mereological relations which they bear to the smaller items of their own category which make them up, and from the formal ontological relations, like involvement and instantiation, which they bear to entities of other categories.²⁶

Causation

Events are the causal relata. Anything that is caused, or has an effect, is in event. This, at any rate, has been the standard, but by no means unanimous, view in the literature on causation.²⁷ Accounting for causation is the primary motivation for many theories of events. Lewis, for example, has a detailed and excellent theory of causation, but one that will not work unless a suitable theory of events is developed.²⁸ Other theorists have argued that events must have a certain granularity or modal profile in order to avoid counterexamples in the theory of causation.²⁹ I am taking a different approach. This is not a paper about causation, and my ontology of events is not primarily responsive to puzzles about the nature of causation. It would be nice if my theory fit well with the best theories of causation, but investigating this question will have to be left to subsequent work. Therefore, this section will focus on how causation relates to the other relations that I have identified, especially involvement.

First, we should not rule out epiphenomenal or uncaused events by definition—if there are no such events, then this is surely a substantive philosophical thesis. Second, I will not be weighing in on several of the controversies concerning the causal relation present in the

²⁵ Lewis's set-theoretic nominalism, developed in his (1983) is importantly distinct from this extreme view. Lewis identifies "instantiates" with "is a member of," a relation holding between an element and a set, but does not succeed in reducing the latter to a mereological relation (though see his (1991) for an interesting discussion).

²⁶ For a discussion of formal ontological relations, see Lowe (2005: chapter 3).

²⁷ Schaffer (2016).

²⁸ Lewis (1986, 241).

²⁹ Schaffer (2016) identifies the relations between the two issues.

literature, like ones concerning its adicity, reducibility or transitivity. The only question about causation which I must take a firm stance on is the nature of the causal relata, which are events on my view. I will also adopt the standard assumptions that causation is irreflexive and asymmetric.

We are now in a position to ask how causation interacts with the two relations already discussed—involvement and parthood. For example, one question is: if E2 and E3 are both proper parts of E1, and E2 and E3 are disjoint, then can E2 and E3 stand in causal relations? An affirmative answer seems warranted. We often want to call extended processes where one stage of the process causes a subsequent stage a single event. Lewis calls this “piecemeal causation” and gives the example of a recession.³⁰ Prior states of an economy, together with the laws of economics, cause the subsequent state of the economy. There is a precise definition concerning when a series of states compose “a recession,” even though the states stand in causal relations with one another. Thus, we should allow the parts of some events to stand in causal relations with one another (though, of course, not all causation is piecemeal).

There are two mereological relations which, if two events stand in those relations, preclude them from standing in causal relations. Those are parthood and overlap. If E1 is an improper part of E2 (i.e., $E1 = E2$), then E1 may not cause E2, for self-causation is impossible. If E1 is a proper part of E2, then E1 may not cause E2 or vice versa, for causation of whole by part or part by whole is likewise impossible. Causation is simply not the kind of thing which relates events to themselves, or parts to their wholes—those relations are identity and parthood, respectively. Once we accept these premises, though, we should be skeptical that two events which overlap stand in causal relations. Here’s an argument for this: consider two events E1 and E2 which completely overlap: they share all of their parts. Causation of E1 by E2 would then be self-causation, given the uniqueness of event composition, which I argued for above. But now imagine that events E1 and E2 almost entirely overlap: they have but one part among many that they do not share. Causation of E1 by E2 in this case seems just as problematic as pure self-causation, even though E1 and E2 are not identical. We continue the series until the events share but one part. And unable to identify a point in the series which would be a natural cutoff to start to allow overlapping causation, we are forced to conclude that overlapping causation is indeed impossible. Once we look at things this way overlapping causation starts to look like simply an

³⁰ Lewis (1986, 172-175).

impure case of self-causation (as does causation of part by whole). Though two overlapping events cannot stand in causal relations, two over-involving events can. Example: I ate a dinner with food poisoning, which caused me to vomit later—I was involved in the meal and the vomiting.³¹ Now we have seen several ways in which our discussion of event mereology and involvement has implications for causation, we can move on to a discussion of instantiation.

Instantiation

Events instantiate properties, just like objects do. Of course, events do not have masses, shapes, colors, or any of the other perceptible properties that so easily distinguish ordinary objects. Here are some properties that they do have. They have lengths in time and size in space. They have extrinsic properties, such as being the objects of intentional attitudes, bearing distance relations to other things and similarity relations to other events. Events can likewise have qualitative intrinsic properties.³² Jim's walk may be slow, contemplative, deliberate, etc. Being a kickoff, fight, birth, flight, shout, concert or commencement are all properties of events. Some properties of an event are essential to it: an event could not accidentally be a kickoff, just like a material object could not accidentally be a human being. By contrast, Jim's walk is only accidentally slow: the walk that he walked could have been fast.

Several questions can now be addressed. First, is the relation which relates properties to objects the same as the relation which relates properties to events? Here are two reasons to think so. First, we frequently talk of properties themselves bearing properties, but do not suppose that there is a special instantiation relation which relates higher-order properties to the properties which bear them, distinct from the instantiation relation which relates properties to objects. If this case does not call for a *sui generis* instantiation relation, we should not posit a *sui generis* property-event instantiation relation. Second, we should avoid positing such a relation on grounds of ontological parsimony. Rather, there is only one relation relating properties to the entities of any ontological category which instantiate them: instantiation. More generally, we should strive to give a unified account of how events and objects possess properties.

³¹ Perhaps only pairs of overinvolving events stand in causal relations: If A causes B then A overinvolves B. This principle strikes me as a plausible constraint on causation, but I cannot investigate it further here.

³² This fact is what motivates Davidson's treatment of events, examined below.

Second, observe that there are some properties which events and objects may both possess (e.g. being six feet from), some which only events can possess (e.g. being a kickoff) and some which only objects can possess (e.g. being a football). It would be good to have a characterization of which properties fall into each of the three classes, and some indication of the relative size of the classes. As a first approximation: the only properties which events and objects could both instantiate have adicity greater than one. Events and objects both stand in spatial and temporal distance relations, are the objects of intentional attitudes, etc., but it is difficult to find a (reasonably natural) monadic property which is instantiated by both events and objects, like weighing 5kg, being an assassination, being a clown, etc. This hypothesis would be indirectly supported if the only properties which objects and properties could both instantiate had adicity greater than one as well, which seems to be the case. This hypothesis, if on track, is evidence that events are an irreducible ontological category in addition to objects and properties. If events and objects were really the same kind of thing, we would not expect a substantial bifurcation in the properties that they can instantiate, though this is something that we observe. The best explanation of the fact that some things can instantiate a class of properties and others cannot is the fact that the two classes of things are in fact distinct ontological categories. This thought must be worked out in greater detail, but it is at least suggestive: the differences in the properties which objects and events can instantiate likely indicates larger differences in their ontology.

Finally, the properties of events and the properties of objects both have a naturalness ordering.³³ The set of trees and quarters is less natural than the set of trees because the members of the latter set are more intrinsically similar to each other than are the members of the former. An analogous naturalness structure applies to the properties of events. The set of events taking place in Paris today is less natural than the set of sneezes in virtue of the greater intrinsic similarity among the members of the latter set. This naturalness structure interacts with the other aspects of events we have discussed, particularly with causation. The most natural properties of an event are those featured in the nomic regularities under which the event's causal relations are subsumed, and extrinsic or disjunctive properties are not as natural. There are tricky questions, though. Is there one naturalness ordering for the properties of events, and a distinct naturalness ordering for the properties of objects, or just one naturalness ordering for all properties? Each option has its advantages and disadvantages: scientific theories quantify over events and objects

³³ See Lewis (1983) for the original motivation and idea and Dorr (2019) for a recent literature review.

both, and the idealized endpoint of physics which is supposed to supply the perfectly natural properties (on Lewis's account, at least) may do this as well, in which case it would not be good to have a disunified naturalness ordering. And it intuitively seems like we can make naturalness comparisons between properties of events and properties of objects—but this would not be the case if the properties of objects and the properties of events were incomparable in naturalness. At the same time, if the thought of the last paragraph is on track, that there are no monadic properties which can be instantiated by events and objects, then this would seem to call for separate naturalness orderings.

It goes without saying that there are a lot of questions still to be answered about the relations between objects, properties and events. Nevertheless, I hope that the preceding discussion has clarified the nature of events and their role in my larger three-category ontology. Thinking about the relations of key importance, especially involvement, that events bear to other, more familiar, things is the best way I know to get a grip on what events are. For the rest of the paper, we will use this framework to give identity conditions for events.

III. The Individuation of Events

The last section examined four relations in which events stand: parthood, involvement, causation and instantiation. Involvement was the only unfamiliar notion, since it has been unjustly neglected by theorists of events. In this section, we shall see how this neglect has led philosophers to mistaken views about the individuation of events. I will examine these views, highlight their flaws and develop an alternative: events are individuated by their involvements.

Davidson and Quine on Event Individuation

Perhaps the most well-known treatment of events is due to Donald Davidson. On his account, events are individuated by their causes and effects:³⁴

(C&E): $E_1 = E_2$ iff $(\forall E: E \text{ caused } E_1 \text{ iff } E \text{ caused } E_2)$ and $(\forall E: E_1 \text{ caused } E \text{ iff } E_2 \text{ caused } E)$.

Davidson does not defend this criterion at any great length, but does note that if it is true, it offers an explanation of why we so easily are able to uniquely refer to events by identifying their

³⁴ Davidson (2001, 178-9).

causes and effects. In addition, it explains why the best evidence for the identity of two events is that we discover that they have the same causes and effects.³⁵

To show that this criterion is incorrect, we must find a counterexample. There are no counterexamples to the left-to-right direction. But there are counterexamples to the right-to-left direction. That there could be epiphenomenal or uncaused events creates worries for C&E. I will illustrate in the case of epiphenomenal events. Suppose that epiphenomenalism about mind is true. Then C&E counts as identical two intuitively distinct events. I am on a road trip in Canada and stop to look at a map. Unfamiliar with Canadian geography, I form the belief that Manitoba is a Canadian province and I form the belief that Alberta is a Canadian province. These events are distinct because they are the formation of beliefs with different contents. But if the formation of these two beliefs had the same cause (my looking at the map), and each had no effects, then they are identical, by C&E.³⁶ C&E individuates far too coarsely when an event has only causes but no effects, or only effects but no causes.³⁷

There are more problems with C&E. Quine argued that C&E is circular, even though it does not contain an identity sign on the right-hand-side. Identity conditions must obey a stronger non-circularity requirement: they may not quantify over the kind of thing for which we are giving identity conditions on the right-hand-side, since what we are trying to do is explain how such things are individuated, and quantification takes identity for granted. C&E fails this non-circularity constraint.³⁸

Davidson acknowledged the cogency of Quine's argument and retracted C&E, in favor of a new identity criterion (also Quine's preferred criterion of event individuation):³⁹

(S&T): $E_1 = E_2$ iff the region of spacetime where E_1 occurs = the region of spacetime where E_2 occurs.

This criterion may strike the reader as unnecessarily coarse-grained. Suppose that a ball is spinning and warming at the same time. These seem like distinct events, but S&T entails that

³⁵ Here, Davidson has mental and physical events in mind.

³⁶ A similar argument can be rehearsed for mental events individuated by their phenomenal quality rather than their contents. For suppose that I stub my toe, and as a result I feel visceral pain in my foot, and also feel annoyed at myself for not paying attention to my surroundings and allowing this to happen. These would be the same by C&E.

³⁷ In addition, Davidson's criterion implies that there is at most one event which is both epiphenomenal and uncaused. But intuitively, if there could be one such event, then there could be more than one—perhaps there could be two distinct epiphenomenal and uncaused events, which occur in different regions of spacetime, involve different objects, have different essential and accidental properties, etc. A criterion of event identity should not rule this out.

³⁸ Quine (1985, 166-167).

³⁹ Davidson (2001, 167 & 309)

they are the same event, since they are occurring at the same place and time.⁴⁰ We should dismiss S&T because of the ease of finding such counterexamples to the right-to-left direction, along with the fact that such coarse-grained events create unnecessary difficulties in the theory of causation.⁴¹ However, very finely-individuated events are problematic also, as we will now see.

Kimian Fine-Grained Events

Jaegwon Kim developed a fine-grained theory of events, which contrasts nicely with Davidson's proposal. The identity condition is:⁴²

(SPT): $[x, P, t] = [y, Q, t']$ iff $x=y$, $P=Q$, and $t=t'$.

Here, $[*, *, *]$ is the name of an event, x and y are the constitutive substances of the events, P and Q are the constitutive properties of the events, and t and t' are the constitutive times of the events.⁴³ The granularity of Kimian events depends on the granularity of their constituents, but any plausible theory of properties will render Kim's events too fine-grained. Consider the two events: Brutus's killing Caesar and Brutus's stabbing Caesar. Killing and stabbing are distinct properties, so the two events are distinct by SPT. Indeed, killing swiftly, killing out of revenge, stabbing with a knife, ... are all distinct properties, so there is a plurality of distinct events which occur here. But common sense rightly maintains that there is only one, variously called the stabbing, the killing, etc. It is true that, if, contrary to fact, Brutus had stabbed Caesar but had not succeeded in killing him, then the event which occurred would not have been a killing. The correct way to describe this case is that the event would have failed to have one of the properties that it actually had, not that some event which actually occurred would not have occurred. We might also complain that Kim's account implies widespread causal overdetermination.⁴⁴ Which event of 15 March 44 BC caused the ensuing civil war—Brutus's killing Caesar, Brutus's killing Caesar with a dagger, ...? To select one as the cause would be arbitrary, but to select all would be to severely overdetermine the causes of the resulting civil war.⁴⁵ Finally and most seriously, Kim can be accused of multiplying events beyond all necessity.

⁴⁰ This is Davidson's example. See his (2001, 178-179).

⁴¹ Paul (2000, 240-241).

⁴² Kim (1976, 160-161).

⁴³ Kim generalizes this definition to events involving more than one substance and having n -adic constitutive relations rather than monadic constitutive properties in his (1973, 224-225).

⁴⁴ For this criticism and more, see Rosenberg (1974).

⁴⁵ Some historians think that this war was causally overdetermined, but their thesis should not be trivialized by the metaphysician.

Kim has an interesting response to these objections.⁴⁶ I look at my desk and think that there is only one object here. Then I study the calculus of individuals and realize that there are in fact many objects here: my desk minus particle 1, my desk minus particle 2, etc. The calculus multiplies desks, but this is not problematic because my desk *includes* each of the almost-desks. Likewise, Brutus's assassinating Caesar includes his killing Caesar, which itself includes his stabbing Caesar. One politically significant event with a very rich essence occurred on 15 March 44 BC, but this event includes indefinitely many less-specific versions with less rich essences. Other theorists of events have joined Kim in holding that events can stand in logical relations of "inclusion" or "implication" with one another.⁴⁷ Such a relation is usually posited to get the theoretical benefits of having many fine-grained events, without the ontological cost.

There are three problems with this response. First, the analogy to objects does not go through. The table contains the almost-tables in the mereological sense of having them as proper parts. But the sense of inclusion which Kim and other theorists are aiming for is one of non-mereological inclusion. Suppose that Brutus's killing Caesar had three parts: inserting the knife, twisting the knife, and removing the knife. None of the events with less-specific essences which Kim thinks are included in Brutus's killing Caesar are such proper parts or sums composed of them. Thus, the notion of inclusion needed is actually *disanalogous* to the case used to motivate it.⁴⁸ Second, this move is a category mistake. Events are not the sort of things which can stand in logical relations with one another. Sentences, propositions and facts can stand in such relations, but particulars located in space and time, like objects and events, cannot stand in logical relations. Finally, no theorist of events has developed the notion of inclusion to such an extent that postulating it does not seem like an *ad hoc* move to respond to an objection.

Individuating Events by Involvements

We have seen problems with each of the prominent accounts of event individuation in the literature. Events are not individuated by their 1. Causes and effects 2. Locations in space and time or 3. Constitutive triples. To avoid counterexamples, a criterion should be coarser than

⁴⁶ Kim (1976, 170).

⁴⁷ Lewis (1986), Yablo (1992) and Jones (2013) are among these.

⁴⁸ This difficulty is also pointed out by Paul (2000, 238-9) and Bennett (1988, 83).

Kim's, but finer than Quine and Davidson's. Involvement, the relation we have been focusing on throughout the paper, allows just this:

(INV): $E1 = E2$ iff $\forall O: O \ \$ E1$ iff $O \ \$ E2$.

This identity condition has several desirable features.

Benefit 1: Passes Quine's Test for Non-Circular Individuation

Quine argued that it is impermissibly circular to quantify over a type of thing in the identity conditions for that kind of thing. INV does not do this. On my view, events are identical or distinct in virtue of the identity and distinctness of the objects involved in them, so we have not presupposed the identity and distinctness of events in a way which Quine identified as problematic. INV is compatible with a number of different identity criteria for objects. One could hold that the identities of objects are brute, determined by the identity of the properties which they instantiate, the regions of space and time they occupy or something else. The one identity criterion for objects precluded by INV individuates them by the events which they are involved in. This would render the pair of identity conditions circular. This is not a very attractive identity criterion for objects, though.

Benefit 2: Events Have Intermediate Granularity

INV is intermediate in granularity between Davidson's coarse-grained account and Kim's fine-grained account. INV and S&T give the same result in some cases, such as the spinning and warming sphere. In other cases, INV sees distinct events where S&T sees only one. This is because of the fact, argued for above, that all objects present in a region of spacetime need not be involved in an event which occurs in that region—recall the example of the butterfly and the game. There can be two distinct (indeed, non-overlapping) events which occupy the same region of spacetime, yet involve different objects present in that region. For example, a marathon and a financial crisis can both occur in New York City on the same day. The former involves runners and streets, and the latter involves bankers and buildings. INV carves more finely than S&T. INV is more coarse-grained than Kim's account because it leaves off the problematic parameter in Kimian constitutive triples, properties. INV allows events to have constitutive objects, their involvements, and, possibly, constitutive times (more on this below). The SPT-distinct events of Brutus's stabbing Caesar and Brutus's killing him do not have different involvements, so are not

INV-distinct. My account is thus most similar to Kim's, but modifies it by leaving off the parameter which makes the identity conditions given by Kim implausibly fine-grained.⁴⁹

Benefit 3: Immune to Counterexamples

The left-to-right direction of this identity condition is immune from counterexamples, on pain of contradiction. For the other direction to fail, there must be distinct events which involve the very same objects. At first glance it seems that such counterexamples are abundant. There may be synchronic or diachronic counterexamples.⁵⁰ Consider the inauguration of Kamala Harris, which took place on 1/20/21. Arguably, two events with the same involvements occurred at this time: the inauguration of the Vice President, and the inauguration of the President of the Senate. Under the constitution one person fills both roles, though the roles have distinct responsibilities. A diachronic counterexample: a church choir rehearsal occurs just before a church softball team practice, where the choir and the softball team have the same members.⁵¹ The rehearsal and the practice are clearly distinct events, just as the choir and the softball team are clearly distinct groups. So, it might be thought that the identity criterion that I have provided is not fine-grained enough to capture the distinctness of events in these examples.

There are several ways to respond to purported counterexamples. The first, which will work in almost all cases, is to liberalize involvement. For any given event, we can be conservative in our intuitions about what objects are involved in it, recognizing only a few involved objects, or liberal, recognizing many. In general, the more objects involved in a given event, the more difficult it is to find cases where two events have the same involvements. For example, objects other than the people participating in them are involved in the choir and softball practices. Also involved are the chairs, hymnals, piano, etc. and uniforms, field, balls, etc., respectively. Given these extra involvements, this case is no longer a counterexample to INV.

⁴⁹ Kim's account is often thought to imply that events have their constitutive substances, properties and times essentially. Kim (1976, 171-173) disputes this, but seems ultimately undecided about the essentialist consequences of his theory. I hold that events do not have their involvements essentially, though their involvements are what individuate them in the actual world, but cannot discuss the modal profile of events in detail here.

⁵⁰ Analogous difficulties are present when individuating objects. Multi-thingers argue that two distinct objects can have the same parts and be present in the same region of space and time (e.g. the statue and the clay). And everyone who thinks that objects persist must deal with a diachronic version of the problem—the very same bits of material could one day compose a tree and the next day compose a desk. So, the parts of an object cannot be used to individuate that object, just as, so the objection runs, objects cannot be used to individuate events, synchronically or diachronically.

⁵¹ This example is drawn from the literature on groups. See Epstein (2015).

Since I have not given a precise answer to SIQ in this essay, I cannot provide a definitive explanation of why an object is involved in an event, and must rely on intuitions as a guide to involvement. However, I think intuitions are sufficiently uniform to resolve most of the troublesome cases. The hymnals are involved in the choir practice because the qualitative character, causal relations and modal profile of the event depends on the hymnals. Likewise, there could not be a softball game without bats and balls. Above, I identified more general reasons to be more liberal with involvement: the right answer to SIQ will probably involve some supervenience claim relating the properties of an event to the objects involved in it. The properties of an event usually depend on a wide variety of objects (as the case of the choir practice and softball game shows), so this generally points to a more liberal notion of involvement. Thus, here is a general strategy for responding to alleged counterexamples to INV: if we think two events have the same involvements, then we have failed to identify all of the involvements of one or the other. If the qualitative character, causal relations, properties or modal profile of an event depends on an object, then that object is involved in that event.

The second strategy bites the bullet, holding that two intuitively distinct events which have the same involvements are in fact the same. We can redescribe some situations to eliminate commitment to two distinct events. There are not two distinct inaugurations which Harris was involved in on 1/20/21, one to make her Vice President and the other to make her President of the Senate. Rather, being President of the Senate is one of the things she will do as Vice President. INV would handle Davidson's case of the spinning and warming sphere in the same way—the spinning and the warming are not two distinct events, but rather pick out two aspects of the same event. We sometimes identify two aspects of an event which are salient given our interests, and mistakenly hold that these aspects correspond to distinct events. Kim took this mistake to an extreme by holding that any distinct properties correspond to distinct events. This mistake is responsible for many would-be counterexamples to INV. In such cases, instead of being committed to two distinct events, we should hold that our descriptions pick out two properties of one event.

One might think that going four-dimensional would help the defender of INV respond to counterexamples. For one, diachronic counterexamples to INV could never arise; since no objects exist for more than one instant, there could not be two events at different times which

involved the same object.⁵² But as we noted above, four-dimensionalist views about the nature of objects eliminate the need for a theory of events, since they collapse the distinction between objects and events. So we should not become four-dimensionalists in response to putative counterexamples to INV.

The final, and perhaps most attractive, way of responding to counterexamples holds that events involve the regions of space and time at which they are located.⁵³ This move automatically eliminates any diachronic counterexamples in much the same way as four-dimensionalism does, without accepting the four-dimensionalist ontology. However, it also has a number of other advantages. This move would increase simplicity by eliminating the “occurs at” relation which relates events and regions of spacetime, by assimilating it to the “involves” relation relating events and objects. This improves the account of events by reducing the primitive relations in which events stand to other entities. However, it does carry a commitment to substantivalism about space and time: some may see this as a benefit, others may see it as a cost.⁵⁴ If space is just another kind of thing, as on the substantivist picture, then occurrence can easily be assimilated to involvement. But this move is unavailable if space and time are relations between particulars.⁵⁵

A second benefit of this move is that it would also automatically entail, given the identity conditions under consideration, that event recurrence is impossible. Some theorists, such as Roderick Chisholm, believe that events recur, because they think that events are more like properties that can be instantiated by multiple particulars than particulars in their own right.⁵⁶ Given the ontology of events advanced here, this is a non-starter, since events are particulars located in space and time. So rather than being an *ad hoc* move to avoid a counterexample, holding that events involve regions of space and time turns out to reinforce other aspects of the theory, and rules out alternative possibilities.

⁵² Under the reasonable assumption that for an object to be involved in an event at a time, the object must exist at that time.

⁵³ Holding that their positions in space and time help to individuate events does not mean that events have their locations in space and time essentially. See Kim (1976, 171-173).

⁵⁴ See Dasgupta (2015) for a contemporary introduction to the issue.

⁵⁵ If space and time are relations between objects, then events would bear the involvement relation to some relations, and to some objects. But events should bear the instantiation relation to all of the properties and relations to which they are related, and the involvement relation to all of the objects to which they are related, as discussed above.

⁵⁶ Chisholm (1970).

A final benefit relates to causation. If events are individuated by their involvements, then there may not be enough events to go around as causes, since there can be at most one event which has no involvements. However, there are many absences, vacuums and other non-occurrences in the world, which each may have distinct causes and effects. Again, it looks like INV carves too coarsely.⁵⁷ To resolve this problem, we must say that either causation relates entities other than events (such as absences or states) or revise our identity conditions. I have claimed above that events are the causal relata, and have given reasons for this view. Holding that events involve the regions of spacetime at which they occur sidesteps counterexamples of this kind though, since two events may involve distinct regions of spacetime, and yet involve no objects other than regions of spacetime. More generally, absence causation can be construed as a species of event causation on this model, so long as absences can be located at empty regions of space and time. Two vacuums, or absences, are distinct because they are located in different regions of space and time, and if these are events which involve the regions at which they are located, the problematic counterexamples can be avoided.

IV. Conclusion

Events are an interesting and under-studied part of the world. In this essay, I have sought to develop an account of events which is, in part, an elaboration and formalization of our ordinary beliefs about the events which we take part in and observe every day: football games, elections, snow storms, birthday parties, births, deaths, concerts, and many more. Events bear interesting relations to entities more familiar to the metaphysician, like objects and properties, and I have developed a theory of how events interact with these other entities. In particular, once the relation between events and objects, involvement, is well understood, a number of theoretical problems about events become more tractable. I focused on the individuation of events in the second half of the paper and argued that events are individuated by their involvements. There is much more work to be done in the theory of events though, to understand the modal profile of events, the nature of the properties of events, and especially in relating my conception of events to the problems in the theory of causation which have largely been set aside in this paper.⁵⁸

⁵⁷ Thanks to [redacted] for raising this case in conversation.

⁵⁸ Thanks to [redacted].

Appendix: Mereology of Events and Objects

In this appendix, I will prove a theorems about the mereological structure of events following from (A1) – (A3) and (INV), the identity conditions for events (reprinted below). The theorem is that if the mereology of events is atomless, then the mereology of objects is too, but not vice versa. I provide a proof and a countermodel, respectively.

(A1) $\forall E1, E2, O$: If $O \$ E1$ and $E1 < E2$, then $O \$ E2$.

(A2) $\forall E, O1, O2$: If $O1 < O2$ and $O2 \$ E$, then $O1 \$ E$.

(A3) $\forall E1$: If $\exists E$: $E \ll E1$, then $\forall O$: If $O \$ E1$, then $(\exists E$: $E \ll E1$ and $O \$ E)$.

(INV): $E1 = E2$ iff $\forall O$: $O \$ E1$ iff $O \$ E2$.

Theorem: If $\forall E1 \exists E2$: $E2 \ll E1$, then $\forall O1 \exists O2$: $O2 \ll O1$.

Proof: We will pursue a proof by *reductio*.

(1) $\forall E1 \exists E2$: $E2 \ll E1$ (supposition for reductio).

(2) $\sim \forall O1 \exists O2$: $O2 \ll O1$ (supposition for reductio).

(3) If $\sim \forall O1 \exists O2$: $O2 \ll O1$, then $\forall O1 \exists O2$: $(\forall O3$: $\sim O3 \ll O2)$ and $O2 \ll O1$ (premise).⁵⁹

(4) Consider any event E with any finite number of involvements $O1, O2, \dots, On$. Let $\alpha[O1, O2, \dots, On]$ denote the set of atoms making up all of the objects $O1, O2, \dots, On$. By weak supplementation and (1), E has at least two immediate proper parts.⁶⁰ Assume for simplicity that there are only two and call them $E1$ and $E2$.

(5) By (A3), every element in $\alpha[O1, O2, \dots, On]$ is involved in either $E1$ or $E2$. Let $I(E)$ denote the set of atomic objects involved in event E . By (INV), $\sim I(E1) = I(E2)$. This implies that $I(E1) \subset \alpha[O1, O2, \dots, On]$, since $I(E2)$ must have at least one involvement.

(6) Now repeat, steps (4) and (5) in the argument finitely many times for event $E1$ rather than E .

⁵⁹ This simply says that if there are some atomic objects, then all objects are ultimately made of atoms, assuming the reflexivity and transitivity of $<$. See Varzi (2019, sect. 3.4). This strengthening of (2) is appropriate since it ensures that we could not have a situation where some objects were made of atoms and others were made of gunk, or where some object was made of both atoms and gunk.

⁶⁰ E^* is an immediate proper part of E iff E^* is a proper part of E and there is no other proper part of E which E^* is a proper part of.

- (7) Eventually, we will reach an event E^* (a proper part of E , proper part of E_1 , etc.) which involves exactly one atom A . By (1) and weak supplementation, E^* has at least two immediate proper parts E^*1 and E^*2 .
- (8) But either A is involved in exactly one of these events, both, or neither. (No object other than A can be involved in E^*1 or E^*2 , since if it were, by (A2) that object would be involved in E^* , which by hypothesis has A as its only involvement). A could not be involved in neither, for then E^*1 and E^*2 would have the same involvements (namely, none) and would by (INV) be the same event. A could not be involved in both, for then E^*1 and E^*2 would have the same involvements (namely, A) and would by (INV) be the same event. If A were involved in E^*1 but not E^*2 , then no events would be involved in E^*2 . But by (1) every event has at least one proper part. Call E^*2 's proper part $E^*2.1$. Since E^*2 involves no objects, $E^*2.1$ could not involve any objects by (A3). But E^*2 and $E^*2.1$ share the same involvements (namely, none), so would by (INV) be the same event. Something cannot be identical to its proper part. Contradiction. QED.

Countermodel: The converse of the theorem is: If $\forall O_1 \exists O_2: O_2 \ll O_1$, then $\forall E_1 \exists E_2: E_2 \ll E_1$. This statement is false. Here is a countermodel. Let each natural number represent a unique object (all of which are made of gunk). Now suppose that there are a finite number of events, 5 atomic events, for example, represented by the first five letters. Here is the model:

1 \$ A
 2 \$ B
 3 \$ C
 4 \$ D
 5 \$ E, 6 \$ E,...

The problem here is simply allocating an infinite number of objects made of gunk to a number of atomic events. The event E is an atom, and involves an infinite number of objects. Even adding the stronger premise that there are no “eventless objects” (i.e., objects that are involved in no events) the converse of the theorem still fails (the above model obeys that constraint). I suspect that we would need a premise which held that an atomic event may have only one involvement to ensure the truth of the converse of the theorem. But this premise is false. Consider two

fundamental particles binding to each other. On my view this is an atomic event involving two atomic objects. Nor do atomic events need to involve only atomic objects: they can involve composite objects too. Example: a proton binds to an electron to form a hydrogen atom. And indeed, as the model above showed, an atomic event which involved infinitely many objects all of which were made of gunk is at least a metaphysical possibility.

Hence, an atomic event mereology is compatible with both atomic and atomless object mereologies, but, the theorem showed that an atomless event mereology must be accompanied by an atomless object mereology.

Bibliography

- Bennett, J. (1988). *Events and their Names*. Hackett Publishing Company, Inc.
- Casati, R., & Varzi, A. (2020). Events. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Summer 2020). Metaphysics Research Lab, Stanford University.
<https://plato.stanford.edu/archives/sum2020/entries/events/>
- Chisholm, R. (1970). Events and Propositions. *Noûs*, 4(1), 15–24.
<https://doi.org/10.2307/2214288>
- Dasgupta, S. (2015). Substantivalism vs Relationalism About Space in Classical Physics. *Philosophy Compass*, 10(9), 601–624. <https://doi.org/10.1111/phc3.12219>
- Davidson, D. (2001). *Essays on Actions and Events* (2nd edition). Clarendon Press.
- Dorr, C. (2019). Natural Properties. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Fall 2019). Metaphysics Research Lab, Stanford University.
<https://plato.stanford.edu/archives/fall2019/entries/natural-properties/>
- Epstein, B. (2015). *The Ant Trap: Rebuilding the Foundations of the Social Sciences*. Oxford University Press.
- Jones, T. (2013). *The Constitution of Events*. *The Monist*, 96(1), 73–86.
- Kim, J. (1973). Causation, Nomic Subsumption, and the Concept of Event. *The Journal of Philosophy*, 70(8), 217–236. <https://doi.org/10.2307/2025096>
- Kim, J. (1976). Events as Property Exemplifications. In M. Brand & D. Walton (Eds.), *Action Theory: Proceedings of the Winnipeg Conference on Human Action, Held at Winnipeg, Manitoba, Canada, 9–11 May 1975* (pp. 159–177). Springer Netherlands.
https://doi.org/10.1007/978-94-010-9074-2_9
- Leonard, H. S., & Goodman, N. (1940). The calculus of individuals and its uses. *The Journal of Symbolic Logic*, 5(2), 45–55. <https://doi.org/10.2307/2266169>
- Lewis, D. (1983). New Work for a Theory of Universals. *Australasian Journal of Philosophy*, 61(4), 343–377.
- Lewis, D. (1986). *Philosophical Papers Volume II*. Oxford University Press.
- Lewis, D. (1991). *Parts of Classes* (1st edition). Wiley-Blackwell.
- Lowe, E. J. (2005). *The Four-Category Ontology: A Metaphysical Foundation for Natural Science*. Oxford University Press.

- Markosian, N. (1998). Brutal Composition. *Philosophical Studies*, 92(3), 211–249.
<https://doi.org/10.1023/a:1004267523392>
- Merricks, T. (2001). *Objects and Persons*. Oxford University Press, USA.
- Paul, L. A. (2000). Aspect Causation. *Journal of Philosophy*, 97(4), 235.
<https://doi.org/10.2307/2678392>
- Paul, L. A. (2016). A One Category Ontology. In John A. Keller (ed.), *Being, Freedom, and Method: Themes From the Philosophy of Peter van Inwagen*. Oxford University Press.
- Quine, W. V. (1985). Events and Reification. In E. Lepore & B. McLaughlin (Eds.), *Actions and Events: Perspectives on the Philosophy of Davidson* (pp. 162–71). Blackwell.
- Rosenberg, Alexander (1974). On Kim's account of events and event-identity. *Journal of Philosophy* 71 (11):327-336.
- Schaffer, Jonathan. (2016). The Metaphysics of Causation. In E. N. Zalta (Ed.), *The Stanford Encyclopedia of Philosophy* (Fall 2016). Metaphysics Research Lab, Stanford University.
<https://plato.stanford.edu/archives/fall2016/entries/causation-metaphysics/>
- Sider, T. (2013). Against Parthood. In K. Bennett & D. W. Zimmerman (Eds.), *Oxford Studies in Metaphysics, Volume 8* (pp. 236–293). Oxford University Press.
<https://doi.org/10.1093/acprof:oso/9780199682904.003.0006>
- Simons, P. (1987). *Parts: A Study in Ontology*. Oxford University Press.
- Strawson, P. F. (1990). *Individuals: An Essay in Descriptive Metaphysics*. Taylor & Francis Group.
- Van Inwagen, P. (1990). *Material Beings* (1st edition). Cornell University Press.
- Van Inwagen, P. (2014). *Existence: Essays in Ontology*. Cambridge University Press.
- Van Inwagen, P (Manuscript). “Dispensing with Ontological Levels: An Illustration.”
<https://andrewmbailey.com/pvi/Dispensing.pdf>
- Varzi, Achille (2019). "Mereology", The Stanford Encyclopedia of Philosophy, Edward N. Zalta (ed.), URL =
 <<https://plato.stanford.edu/archives/spr2019/entries/mereology/>>.
- Yablo, S. (1992). Cause and essence. *Synthese*, 93(3), 403–449.
<https://doi.org/10.1007/BF01089276>