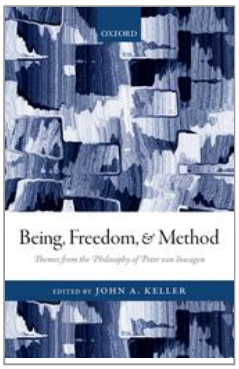

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A One Category Ontology

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Abstract and Keywords

This chapter defends a one category ontology: an ontology that denies that we need more than one fundamental category to support the ontological structure of the world. One category ontologies are deeply appealing: their ontological simplicity gives them an unmatched elegance and sparseness. In the service of a one category ontology, the chapter argues for mereological bundle theory, and explores new ways in which mereological bundle theory can address concerns about the identity of indiscernibles and indiscernibility issues in quantum mechanics.

Keywords: properties, abstracta, constituent ontology, relational ontology, mereological bundle theory, mereology, identity of indiscernibles

An ontology is defined by its fundamental categories. Following Peter van Inwagen (2011), take divisions between fundamental categories to mark "real divisions between things" that determine the basic categorical structure of the world. Speaking metaphorically, the fundamental categorical structure of the world carves the world at its fundamental joints.

The project of determining the fundamental categorical structure of the world descends (arguably) from Aristotle, who started by dividing the realm of being into at least two fundamental categories: the fundamental category of particulars, or *the present-in*, and the fundamental category of universals, or *the said-of*. This gives the world a certain sort of structure, built from things with two different natures, things with the nature of being a bearer of properties or

being a particular, and things with the nature of being borne by particulars. This supports a two category ontology. The idea is that the world exhibits this fundamental distinction between natures, a distinction between individuals or bearers and the properties and relations these things bear. The notion of understanding the ontological structure of the world in terms of divisions between natures is also deeply embedded in the Lewisean notion of naturalness, and is extended in Theodore Sider's (2012) view that the world has fundamental quantificational structure.[1]

I defend a one category ontology: an ontology that denies that we need more than one fundamental category to support the ontological structure of the world. Categorical fundamentality is understood in terms of the metaphysically prior, as that in which everything else in the world consists. One category ontologies are deeply appealing, because their ontological simplicity gives them an unmatched elegance and spareness. I'm a fan of a one category ontology that collapses the distinction between particular and property, replacing it with a single fundamental category of intrinsic characters or *qualities*. We may describe the qualities as qualitative characters **(p.33)** or as modes, perhaps on the model of Aristotelian qualitative (nonsubstantial) kinds, and I will use the term "properties" interchangeably with "qualities". The qualities are repeatable and reasonably sparse, although, as I discuss in section 2.6, there are empirical reasons that may suggest, depending on one's preferred fundamental physical theory, that they include irreducibly intensive qualities. There are no uninstantiated qualities. I also assume that the fundamental qualitative natures are intrinsic, although physics may ultimately suggest that some of them are extrinsic.

On my view, matter, concrete objects, abstract objects, and perhaps even spacetime are constructed from mereological fusions of qualities, so the world is simply a vast mixture of qualities, including polyadic properties (i.e., relations).[2] This means that everything there is, including concrete objects like persons or stars, is a quality, a qualitative fusion, or a portion of the extended qualitative fusion that is the world-whole. I call my view *mereological bundle theory*.

In conjunction with offering my view as an appealing theory of what is fundamental, I shall argue that the distinctions made by the neo-Aristotelian polycategorical theorist are metaphysically unfounded—there are no reasons to endorse them apart from philosophical habit and prejudice. The assumption that there is a fundamental categorical distinction is an artifact of an outdated neo-Aristotelian worldview according to which objects are substantial, chunky, extended, and complete, while properties are abstract, unextended, and incomplete. We don't need a fundamental categorical division between particulars, individuals, or spacetime regions and their properties, nor do we need a fundamental categorical division between things, individuals, or bearers and the qualities "borne" by them. Polycategorical ontologies that postulate

multiple fundamental categories assign excess structure to the beast of reality, making a mess of the carving. The one category ontologist hews the beast at its ontological joints.

Mereological bundle theory is not just parsimonious in terms of the fundamental categorical structure it assigns to the world. It is also parsimonious in the way it builds the world from the constituents of the categories, as it builds the world from one simple kind of relation: composition. Because it rejects the need for a fundamental division between object and property, it rejects any need for a primitive connecting relation of "instantiation." And instead of bringing in new primitive bundling relations such as relations of "compresence" or "co-instantiation," mereological bundle theory takes bundling to be a form of mereological composition, developed using our antecedent notions of parthood (see Paul (2002, 2006a, and 2012) for extended treatments of these ideas).

The one category ontologist may grant, of course, that there exists additional structure. She might hold that this further structure is merely *ideological*, that is, it is a sort of non-ontological structure that is based on primitive expressions and demarcations we make in our descriptions of the world.[3] Or, she might grant that there is a kind of derivative ontological structure, such as a mereological structure where sums are constructed from simples. What matters is that none of this **(p.34)** additional structure, whether ideological or ontological, involves endorsing the existence of additional fundamental (or irreducibly emergent) categories in the world.[4] The appeal of a one category ontology is not that there is *no* structure in the world, but rather that there is no *fundamentaldivision* between real natures in the world, and no new real natures are *emergent* in the world.

While my view is revisionary in some ways, it preserves many features of our ordinary perspective on the world. It can take objects to be located in spacetime (by being qualitative fusions that are fused with spatiotemporal relations or relational properties), and can assume that there are certain primitive modal constraints on the mixture that is the world, where such constraints are best thought of as *de dicto* modal truths of the system. These *de dicto* modal truths endow the world with various desirable features: they make it the case that composition is restricted in certain ways, that the laws of thermodynamics are true, and so on. My qualitative story fits well with the picture of the world given to us by quantum mechanics, especially quantum field theory. It also fits well with the thought that properties, especially located properties or "finegrained events," are what are subsumed by causal laws and are the best candidates for the causal relata (see Paul (2000) and Paul and Hall (2013) for more on finegrained events as the causal relata).

2.1 Ontological Category Theory

Polycategorial ontologies distinguish the object from its properties. The intuitive basis often given for the distinction is that objects are chunky, substantial, or concrete things, whereas properties are somehow thinner and less substantial, or as some would describe it, “abstract.” This neo-Aristotelian distinction is supposed to track a real difference between what objects *are* and what properties *are*. Traditional suggestions for the fundamental ontological categories that make such distinctions include ontological categories for *substances, substrata, particulars, universals, properties, objects*, or *spatiotemporal regions*, and these suggestions have received renewed attention in the work of philosophers like David Armstrong (2010), E. J. Lowe (2006), and Peter van Inwagen (2011).

Substancetheory takes objects to be, fundamentally, primitively unanalyzable or irreducible substances of different sorts, and holds that substances have properties by standing in some sort of relation to universals or other entities. As such, it is a relational two category ontology. According to substance theory, what exists are concrete objects (in one category) and abstracta like properties (in the other category), and it is *relational* in that the concrete objects have their properties by bearing relations to certain abstracta.[5]

Substratumtheory also distinguishes objects from properties, taking objects to be constructed from primitively individuated substrates and properties. As such, it is a two category constitutive ontology where concrete objects have entities from the property category and from the substratum category as constituents. Concrete **(p.35)** objects are constructed from substrata and abstract objects like universals, or abstract particulars such as tropes, so that the substratum has the properties. It is a *constituent* ontology because objects in the world have these things as constituents.[6] D. M. Armstrong (1989, 1997, 2010) and C. B. Martin (1980) endorse substratum theories, and take properties to be ways objects are.

Both the substratum theory and the substance theory emphasize the differences between *particulars* or particular things like substances and substrata, and properties. As a trope theorist, Martin’s emphasis is on the difference between bearers and things borne as opposed to an emphasis on a difference based purely on particularity. Martin argues that tropes are co-dependent and need to be combined with a bearer to “complete” the object (Martin 1980: 7–8).

There are polycategorical views that are related to these approaches but defy any straightforward categorization, such as Kit Fine’s (1999) hylomorphic *theory ofembodiment*. Like substance theory, it takes its cue from Aristotle’s thought that objects have a formal and a material element, but like substratum theory, objects have constituents and structure. On Fine’s view, objects are constructed from an intensional or conceptual relation R and material parts a and b. R has a

certain structural “form” that is “embodied” in matter such that *a*R*b* for material constituents *a* and *b*. As described, Fine’s view is a two category constituent ontology. E. J. Lowe (2006) defends a four category ontology where the world is constructed from substances, substantial kinds, modes, and nonsubstantial universals and relations of instantiation, characterization, and exemplification.

A somewhat different, but very popular, way to endorse a two category distinction involves making a distinction between spacetime, in terms of points, regions, or spatiotemporal substances of some sort, and n–adic properties (for example, Sider 2008). An ontology which takes spatiotemporal regions to be primitively individuated substances instantiating properties, in line with relational ontologies, or takes spatiotemporal regions to be substrata bearing properties, in line with constituent ontologies, is a two category ontology. Many “supersubstanvialists” are, perhaps implicitly, committed to a two category ontology of some kind. Again, the one category ontologist rejects such theories because they assign excess structure to the world. For the monocategorical theorist, spacetime consists of spatiotemporal relations, or properties, or of relational properties, suitably defined. It does not consist of regions that are different in nature from n-adic properties and serve as their “bearers.” Spacetime is not itself a distinct fundamental category, nor is it constructed from substantial entities of any Aristotelian non-qualitative kinds. The one category theorist holds that reality needs no such division between spatiotemporal regions and nonspatiotemporal qualities.

Traditional bundle theory, such as the trope bundle theory of D. C. Williams (1953) or Peter Simons (1994), or Russellian bundle theory, which takes objects to be bundles of universals, is a constituent ontology that takes properties to be constituents of objects. As such, traditional bundle theory makes an ontological distinction **(p.36)** between the bundle and its constituents.[7] This distinction is not always as sharp as that made by defenders of other constituent and relational ontologies. Traditional bundle theory counts as a one category ontology in the sense that it constructs the members of the object category from the members of the property category.[8] But it distinguishes between concrete objects and their abstract constituents, the properties that are bundled together to make the object, and the distinction builds on the same tradition of distinguishing between bearers of properties and the properties themselves that two category ontologies rely on.

This distinction is most obvious with Russellian bundle theories involving transcendent universals, since such universals are not located in spacetime, while the objects constructed from them are. (For reasons like this, van Inwagen (2011) argues that these sorts of bundle theories are really two category ontologies.) But even if the universals are immanent, they are still thought to be abstract in the sense of abstract that picks out “less substantial.”

This sense of “abstract” (arguably derived from “abstraction”) is often the basis for distinctions between properties and objects made by trope theorists. (We also see this in Martin’s substratum theory.) Peter Simons is a traditional bundle theorist who distinguishes the natures of tropes from the natures of objects by marking tropes off as co-dependent entities that cannot exist by themselves: they need to be instantiated with other tropes. Objects, on the other hand, are independent entities that can exist without other objects (Simons 1994). Simon’s distinction has a deep historical basis, and connects with the Lockean distinction between the object as the bearer and the property as what is borne. G. F. Stout (1921) labels tropes as “abstract particulars,” which also suggests this distinction.

Williams distinguishes between the concrete nature of objects and the abstract nature of tropes in terms of ontological completeness: “the more special sort of incompleteness which pertains to what we have called the ‘thin’ or ‘fine’ or ‘diffuse’ sort of constituent, like the color or shape of our lollipop, [is] in contrast with the ‘thick,’ ‘gross,’ or chunky sort of constituent, like the stick in it” (1953: 15). What is explicit in Simons and in Russellian bundle theory, and implicit in Williams, is that while we only need one category of thing, dependent tropes, to start with, we somehow build a new kind of thing, independent objects, from the members of this category. These theories in effect smuggle in two fundamental ontological categories—or perhaps two irreducible ontological categories, the fundamental category of properties with an emergent, irreducible category of objects—in an effort to preserve a distinction between objects and properties.

One sort of one category ontology that competes with mereological bundle theory in terms of parsimony is austere nominalism. Austere nominalism denies that there are any such things as properties at all. There are only objects, taken to be concrete particulars such as individual salt shakers, cats, and rocks (Cf. Loux 1998). These concrete particulars occupy spatiotemporal locations and display features we expect **(p.37)** from such objects, for example, if they are material objects they are impenetrable, and more than one object of the very same kind cannot occupy the very same spatiotemporal location.[9] “The austere nominalist insists that at rock bottom there are only structureless concrete particulars and that talk apparently about properties and the like is simply disguised talk about the fundamental concrete particulars” (Loux 1998: 103) Strictly speaking, nothing has properties, although we may speak as though objects really do have them.[10]

Austere nominalism is unacceptable, for it is insufficiently finegrained. Distinctions between objects fail to capture all the distinctions we need to make. If everything with a heart also has kidneys, or if everything human is also a featherless biped, how are we to capture the distinction between having a heart and having kidneys without endorsing radical views about the role of possibilia in making qualitative distinctions within actual existents? Moreover, it suffers

from empirical problems. First, a theory of entities in the world as constructed from ontologically basic concrete particulars, i.e., localized particles of some sort, is contradicted by standard interpretations of quantum field theory (Cf. D. B. Malament 1996). Second, as I describe in section 2.6, taking fundamental entities such as bosons to be anything like “concrete particulars” is inconsistent with Received Views in quantum mechanics. While parsimony is a virtue, it is unclear to me how to make austere nominalism consistent with fundamental physics, and also unclear how to make it sufficiently accommodating of the qualitative differences we find in our world.

A less austere version of nominalism, *clement* nominalism, takes the view that everything there is is an object, and the fundamental objects are tropes: qualitative located concrete particulars. Clement nominalism is a more interesting one category view than austere nominalism. To accommodate the physics, clement nominalism would need to dispense with its nominalistic overtones by rejecting any metaphysically thick sense of “concrete particular” where such particulars are basic, located, particle-like entities, making it unclear what sense of “object” the view relies upon. At best, it could be thought of as a view where the fundamental entities were tropes. However, for it to be a truly one category view, ultimately it would need to collapse into something very like the versions of mereological bundle theory I describe in section 2.4.

Other sorts of one category views are surely possible, and would have to be evaluated on a case-by-case basis. My aim here is simply to question the current dogma supporting the range of fundamental polycategorical structures put forward by neo-Aristotelians, substance theorists, fans of propertied and related spacetimes, and others, by defending a more appealing and parsimonious monocategorical alternative.

(p.38) 2.2 A Qualitative Mereology

I take the derivative ontological structure of the world, the structure built from the basic constituents of the world, to be mereological structure. Mereological structure is based on relationships between parts and wholes. Such structure is not categorical: sums of properties do not create new natures or real categories. (In this sense, composition is like identity.) I take composition to be the basic building relation of the world, and the individuals that are the basic parts are used to construct everything else there is. What sorts of individuals are the fundamental constituents of the world, the metaphysically prior simples that are fused to create the world-whole? This is the delicate question. In my view, the fundamental constituents are properties, or qualitative natures, and all else is mereologically composed from these.

So the world-whole is built by fusions of qualities. I shall take the basic notion of my mereology to be the primitive notion of “proper part,” and assume that proper parthood is analytically irreflexive, asymmetric, and transitive. With

these notions, along with a principle of supplementation and what I take to be uncontroversial presuppositions about identity and existence, I capture the meaning of “part” with my account of qualitative parts and define qualitative composition (Cf. Simons 1987).[11]

Hence I develop my qualitative mereology by starting with thin notions of parthood and composition, ones which are perfectly well-defined mereologically and are also the basis for classical extensional mereology. Of course, classical extensional mereology takes parts and wholes to be spatiotemporal parts and wholes, where parts are individuals that are—or are defined in terms of occupying—four-dimensional regions of spacetime. But we can apply the basic notion of parthood to other sorts of constituents, and define composition as a relation between these sorts of constituents, just as well as we can develop these notions so that they apply to spatiotemporal regions.

My qualitative mereology is the basis for my mereological bundle theory: properties are literally objects and parts of objects, and properties are bundled using the composition relation. Assuming an appropriate first-order predicate calculus with identity, here are the basic axioms and definitions of my qualitative mereology **M** (“qualitative parts” are property parts).

A_1. For any *x*, *x* is not a proper qualitative part of itself. (Proper qualitative parthood is *irreflexive*.)

A_2. For all *x* and *y*, if *x* is a proper qualitative part of *y*, *y* is not a proper qualitative part of *x*. (Proper qualitative parthood is *asymmetric*.)

A_3. For all *x*, *y*, and *z*, if *x* is a proper qualitative part of *y* and *y* is a proper qualitative part of *z*, *x* is a proper qualitative part of *z*. (Proper qualitative parthood is *transitive*.)

A_4. For all *x* and *y*, if *x* is a proper qualitative part of *y*, there is a *z* such that *z* is a proper qualitative part of y, and *z* is qualitatively disjoint from x. (This is *weak* ***(p.39)*** *supplementation*: if an individual has a proper qualitative part, it has at least one other proper qualitative part.)

D_1. For all *x* and *y*, *x* is a *qualitative part* of *y* iff *x* is a proper qualitative part of *y* or *x* is identical to *y*. (An object’s improper qualitative part is just itself.)

D_2: For all *x* and *y*, *xqualitatively overlapsy* iff *x* and *y* have a qualitative part in common.

D_3: For all *x* and *y*, *x* is *qualitatively disjoint* from *y* iff *x* and *y* have no qualitative part in common.

> D_4: For all *x* and *y, x* is *qualitatively composed* of *y*s (or *x* is a *qualitative fusion* of *y*s) iff *x* has all the *y*s as qualitative parts and has no qualitative part that is qualitatively disjoint from each of the *y*s.[12]

Qualitative composition is neither covertly nor overtly spatiotemporal, nor is it somehow tied to spatiotemporal location or occupation. Like many fans of mereology, I take composition to be restricted, and I recognize the serious problems associated with adequately determining the conditions under which composition occurs. Hence I endorse a brute restriction and correspondingly reject a general qualitative fusion axiom.[13,14]

I have described my properties as "qualitative natures," and taken them to be a kind of repeatable universal, perhaps akin to Aristotle's nonsubstantial forms. Properties are located in virtue of being qualitatively fused to spatiotemporal relations or relational properties. There are no uninstantiated universals. Not just any predicate defines a property, so properties are sparse, and there are no negative properties, merely negative predicates (if an object is ~*F* then it does not include *F* as a part). Properties can be monadic or polyadic (a.k.a., relations).

My property mereology allows fundamental relations, if there are any, to fuse with other properties in just the same way as monadic properties fuse with other properties. The fundamental relations have what we can metaphorically describe as "ends" that fuse to n-adic properties. Now, there might not be any fundamental asymmetric relations. If not, **M** could be made extensional (replacing the axiom of weak supplementation with something stronger to give extensionality). If there are fundamental asymmetric external relations, I take such relations to be relations with a certain sort of intrinsic character: character that influences the structure of a fusion that includes them. Metaphorically speaking, we can understand this as the view that the asymmetric external relation has places, and which of these places other properties and **(p.40)** relations are fused with determines the overall character of the fusion that includes the asymmetric relation. Less metaphorically speaking, the asymmetric external relation has an intrinsic direction such that when it is fused to other properties, the resulting fusion has a certain sort of structure. When asymmetric fundamental external relation *R* is fused with properties *P* and *Q, R* is such that the fusion of *PRQ* is different from the fusion of *QRP*. On this view, asymmetric external relations provide fusions with structure via the mereological composition of properties with relations that have places, so qualitative composition is not extensional. We might describe the result as "neopredicational" fusing.[15] For example, perhaps there is a fundamental temporal relation of direction. If so, then the world will include an asymmetric temporal structuring relation *R*, such that the fusion of *PRQ* has an intrinsic direction because it includes the intrinsic character of R. If so, then the fusion of *QRP* has a different intrinsic direction, even though it has the very same proper

parts. To mark such a difference, we may define primitive predicates D_1 and D_2 that apply to *PRQ* and *QRP*, respectively.

2.3 Parthood and Constructing the World: Traditional Bundle Theories

My denial of any distinction between properties and objects is drawn out by the way that mereological bundle theory, when developed, differs from other bundle theories, including classical trope bundle theories like that of Williams. The central difference between my mereological bundle theory and traditional bundle theories is captured by the notion of qualitative parthood that my view employs. Traditional bundle theorists do not take properties or their instances to literally be parts of objects, while they do take objects to have spatiotemporal parts. (They take properties to be constituents of bundles, but not literally parts in the mereological sense.) This is made reasonably clear simply by the fact that, instead of using qualitative composition as the bundling relation, they use primitive relations like compresence or co-location, whose names have overtly spatiotemporal overtones, to bundle objects.[16] This difference costs them in terms of parsimony, for such bundle theorists must introduce entirely new primitive relations (like consubstantiation) to bundle properties and build the world, in contrast to the mereological bundle theorist, who uses mereology to build the world, and thus takes advantage of our intuitive grasp of parthood and composition as basic building-relations. Moreover, as we shall see, the traditional bundle theorist's way of distinguishing between properties and parts leads to categorical difficulties.

Keith Campbell (1990), who is the clearest about his commitment to tropes as entities that are ontologically concrete and independent (he specifies that tropes are only abstract in an epistemic sense), is also clear about how tropes are bundled using compresence, which is not mereological composition. One traditional bundle theorist, Williams, has described the constituents of the bundle as "parts" of the bundle. But the use of the term "part" here seems to be merely metaphorical, non-mereological, or **(p.41)** non-referentially descriptive in some other obscure sense. Or at least, if Williams and other traditional bundle theorists do mean that properties are literally parts of objects, their views are radically incomplete, perhaps to the point of absurdity.

It is worth developing this point, for exploring the distinction between traditional bundle theory and mereological bundle theory will help to bring out the contours of the latter. That traditional bundle theorists cannot literally be taking properties to be parts of objects seems obvious when we recognize that, for a bundle theory to take properties to be parts of objects, it must describe the basics of its property mereology and explicitly fit it together with a spatiotemporal mereology. There is no such description and no such fitting offered anywhere in the literature about traditional bundle theory. Without an account of the basics of the property mereology and of the fit between the qualitative and the spatiotemporal, the traditional bundle theorist cannot make

sense of how an object can have both property parts and spatiotemporal parts, and so she cannot hope to answer obvious and damning objections.

In particular, parthood is transitive, and, I'd say, analytically so. But how could it be so for those who take properties to be parts along with taking more material, chunky concrete objects as spatiotemporal parts? I have my hand as a spatiotemporal part, and my hand has being hand-shaped as a property part. If parthood is transitive, it would seem that I have being hand-shaped as a part. But I am not hand-shaped, and hence I do not have it as a part. How is the traditional bundle theorist to make sense of this? Is the transitivity of parthood to be denied?

Or consider the way some philosophers think of ordinary material objects as composed of smaller spatiotemporal parts. If objects are composed of smaller spatiotemporal parts, how are they also composed of property parts? How can an object like a chair be literally composed from tropes such as having shape *s*, having mass *m*, having color *b*, etc., while also being composed of spatiotemporal parts involving glue and pieces of wood and leather? The picture of objects as fusions of properties makes no sense unless a relationship between property fusion and spatiotemporal fusion has been clearly developed.

There is a further issue regarding composition that the traditional bundle theorist has to take a stand on: if properties can be parts, do properties compose in all circumstances? Is composition universal, as it is in classical extensional mereology? If the traditional bundle theorist endorses universal composition, then she endorses the existence of, say, fusions of the properties of being square and being round. Not a good result.

If properties are bundled together using some non-mereological relation, we do not need to develop the relationship between a property mereology and classical extensional mereology or do the difficult work needed to define property composition, and so we can at least dodge the problems with transitivity. (That said, the traditional bundle theorist should still explain just how bundling properties to build objects is to be combined with building objects from spatiotemporal parts.) The idea behind bundling is usually that, whatever the bundling relation is, e.g., compresence, it is understood primitively, not as a relation developed using our antecedent notions of parthood and other mereological ideas. Peter Simons sees this clearly, and as a result argues that "Parts is one thing, properties another (and properties of parts something else again)" (1994: 563).

(p.42) It isn't really a surprise that traditional bundle theory does not blend property parts together with spatiotemporal parts, for, as I noted above, traditional bundle theories standardly retain a distinction between properties and spatiotemporal parts based on the intuitive idea that properties exist in a

way that spatiotemporal parts—which are concrete objects—do not. Sometimes this is fleshed out as the idea that properties are somehow less substantial or must co-occur with other properties, while spatiotemporal parts, a species of concrete or material object, do not. “What we standardly call ‘parts’ are a special kind, *independent* parts or *pieces*…” (Simons 1994: 563). Williams also contrasts the way tropes are “fine” or “diffuse” parts with material or spatiotemporal parthood. “To borrow now an old but pretty appropriate term, a gross part, like the stick [of a lollipop], is ‘concrete,’ as the whole lollipop is, while a fine or diffuse part, like the color component or shape component, is ‘abstract’” (Williams 1953: 6). In short, the ontological distinction between properties and objects is perpetrated by treating properties as entities or metaphysical “parts” that are somehow different from the sorts of material objects that can be spatiotemporal parts (proper or improper).

The thought seems to be that property parts are different in kind from chunky, material-object-like spatiotemporal parts because properties are different from “concrete” objects like spatiotemporal parts, and so we must think of them and treat them separately as some sort of non-mereological or metaphysical “part.” But this is wrong. It is just a mistake to think properties cannot be chunky, concrete, complete, or independent. They are chunky, and concrete, and complete, and independent—*becausesome of themare* chunky, concrete, complete, and independent. In particular, some of the properties that are ordinary objects are chunky, concrete, complete, and independent. (As are some of the fundamental physical properties, such as field intensities. See section 2.4.)

Do not be tempted by the fallacious idea that fusing is what somehow “makes” the ordinary object (which is a fusion of properties) chunky or substantial. That’s not how fusing works: it makes many into one, it doesn’t make non-substances into substances or abstract things into concrete ones. And do not be tempted to argue that we know that fusing properties makes the objects chunky or substantial on the grounds that we can somehow see or detect that objects are chunky or substantial while detecting that properties are not. For we cannot *see* or *detect* that fusing makes the properties into chunky, substantial entities any more than we could *see* or *detect* that fusing a bunch of appropriately arranged spatiotemporal parts makes a whole. There is no phenomenological difference between the fused and the un-fused.[17] You can’t see or detect a difference between a plurality of property instances and the fusion of them any more than you could see or detect a difference between a plurality of spatiotemporal simples (or any plurality of spatiotemporal parts) and the fusion of them.

Let me now turn to a final argument: that properties are somehow dependent in a way that objects are not because of the fact that some properties, at least contingently, always co-occur with others. The idea seems to be that properties and objects **(p.43)** have different natures: objects are independent objects while properties are dependent objects. The view that properties are objects

does not dispute the fact of co-occurrence. It is true that some properties in the world are always fused with other properties: as a matter of (contingent?) fact, some properties co-occur. But the fact that there are certain modal relations in the world that ontologically entail that certain properties are always fused (at least in the actual world, and maybe in all possible worlds) does not mean that these properties are somehow ontically dependent. It just means that there are certain facts about the universe that result in certain connections: for example, that anything with mass also has extension. Perhaps these connections are simply contingent facts about how the qualitative profiles of objects are to be completed that are derived in some way from the physical laws of the world. (I like this idea.)[18] Or perhaps they derive from external *de re* modal relations of necessity. In any case, they need not be explained by some sort of internal or intrinsic ontological characteristic of "dependence" that we must ascribe to the properties themselves. The flip side of this point answers the worry about how to restrict composition. If there are deep modal facts about co-occurrence, surely there are also deep modal facts about what cannot co-occur. The mereological bundle theorist can thus deny universal composition to avoid the worry about the existence of round squares and the like.

Recall that the traditional bundle theorist who describes properties as parts (really, mostly Williams, as far as I can tell—others with developed bundle theories usually eschew this language) avoids any clear statement about how a property mereology is fitted to spatiotemporal mereology. If the claim about objects having property parts is merely a metaphor, the traditional bundle theorist dodges the worries about transitivity and avoids having to make sense of how, given qualitative parthood, extended objects can be exhaustively constructed from smaller material parts.

But as my discussion above suggests, such a dodge deepens the divide between property and object, endangering the purity of the bundle theorist's claim to have a truly single-category ontology,[19] and undercutting its claim of superiority over Lockean substratum theories. To the extent that there is an ontological distinction drawn between the natures of the concrete objects and their concrete parts, and the abstract particulars or universals that are their qualitative constituents, traditional bundle theory starts to endorse the neo-Aristotelian's distinction between properties and individuals. And, as I have argued, to the extent that one holds that properties are not literally parts, one holds that properties are not objects, which suggests, if not a categorical difference between the real natures of these things, something very like it.[20] I suspect that traditional bundle theorists, in a misguided effort to preserve philosophical intuitions about material objects that date at least from the days of corpuscular philosophy and Cartesian mechanics, have unwittingly endorsed a categorical distinction between property and object by creating a new category of objects that somehow emerges from the bundling of properties.

(p.44) So there is no need for a categorical distinction between properties and objects. Properties are not “abstract” or “dependent” or “incomplete” entities opposed to “concrete” or “independent” or “complete” objects in any ontological sense at all. Properties are not incomplete while objects are complete. Properties do not need bearers to make objects. Properties and objects are the very same thing. We build fusions of properties from properties, and some of these are what we describe as “ordinary objects.”

Perhaps the one category ontologist denies our commonsense intuitions and ordinary ways of speaking as a consequence: if so, what of it? Such commonsensical intuitions and linguistic conventions are nothing more than a local, parochial effect of the way we pre-theoretically approach the world, dispensable in favor of the massive increase in ontological parsimony which a one category approach brings. We might want to adopt an error theory of ordinary language to handle this fact, following the approach of Sarah Moss (2012) to theories of persistence, or distinguish between ordinary English and philosopher’s English, and look to an ideal interpreter to interpret the relevant sentences of ordinary English in an appropriately philosophical way.[21] The translation manual used by the ideal interpreter can take ordinary object terms to pick out fusions that include properties of having mass, extension, and other properties that are distinctive of chunkiness or particularity, and can distinguish, if need be, between different kinds of predication.

2.4 Parthood and Constructing the World: Mereological Bundle Theory

It seems clear that traditional bundle theorists are unable to navigate the divide between property parthood and spatiotemporal parthood without slipping into a categorical crevasse. Can the mereological bundle theorist do any better? Yes.

She should start with spacetime: if she is to endorse a truly one category ontology, she must start by being explicit that spatiotemporal locations are n-adic properties, not primitive substances or individuals in a second fundamental category. She can do this by taking spacetime to be relational, or by taking spacetime points to be spatiotemporal tropes or trope-like equivalents. If we deny extensionality, we can even recapture a kind of substantivalism about space where we have the same part, a spacetime trope, endlessly repeated as a space of “points,” giving us a space with a global cardinality but without haecceitistic difference.[22] The charms of this substantivalist picture notwithstanding, I shall assume spatiotemporal relationalism.

Once we have a suitably property-theoretic notion of spacetime, there are two models the mereological bundle theorist might use to address the puzzles about spatiotemporal composition. The first model accommodates most of the mainstream metaphysical intuitions about spatiotemporal composition by endorsing two different composition relations, one for qualitative parts and one for spatiotemporal parts, and building the world up from quality-points plus

spatiotemporal fusions. The second model builds the world entirely from qualitative parts, and captures a kind **(p.45)** of holism that is congenial to certain sorts of fundamental physical theories. I'll discuss each model in more detail.

The first model for mereological bundle theory starts with properties qualitatively fused together with locations (understood to be relations or relational properties of having such-and-such locations) to create a mosaic-like lowest compositional level of located, unextended qualitative fusions distributed through a network of spatiotemporal relations. I'll call this model the *mosaic* model. **M** is the mereology that applies to this level of composition. Extended objects are then created using a *different* composition relation and hence a different mode of mereological construction. This second composition relation is defined in the following way. Call each (maximal) located unextended qualitative fusion a "spatiotemporal part." Proper spatiotemporal parthood is defined in the usual way, as asymmetric and transitive, and one can accept a strong supplementation principle to make the spatiotemporal mereology extensional. Further axioms and definitions consistent with classical extensional mereology can be accepted, including unrestricted composition. We might then call our new composition relation "spatiotemporal composition."

On this model, spatiotemporal parts and spatiotemporal composition are embedded in a qualitative, one category ontology, and the relation between qualitative and spatiotemporal composition is clear. The fundamental spatiotemporal parts or "spatiotemporal simples" are qualitative, located fusions of properties, and larger spatiotemporal parts are constructed from a relation defined on these spatiotemporal simples.[23] Rocks, persons, stars, and abstract objects are all fusions built from quality-fusions then fused together by spatiotemporal composition. Such fusions, in addition to being complex constructions of quality and spatiotemporal fusions, are also plain-vanilla property fusions, where the properties fused are the whole (distributed) properties of the object. Take the spatiotemporal fusion of simples s_1 and s_2, where s_1 has the properties of *having a mass of one gram* and *having a semi-circular shape* and s_2 has the property of *having a mass of one gram* and *having a semi-circular shape*. When there is a spatiotemporal fusion of s_1 with s_2, giving us an object with a mass of two grams and the shape of a circle, this is also the fusion of the distributed property of *having a mass of two grams* with the distributed property of *having a circular shape*.

Although there are two sorts of compositional structure in the world, the mosaic theorist fiercely denies that fusing properties together to create located quality bundles gives us an emergent or otherwise irreducible category of "objects," or that the different compositional structures demarcate different fundamental categories in any way. The world is purely qualitative, and spatiotemporal parts are fusions of properties (not emergent objects of any sort). We are simply

building the world with n-adic properties, albeit with different sorts of properties at different compositional “levels.” The loss of parsimony here is a loss of parsimony with respect to the number of composition relations, since there are two species of composition relation, but not with fundamental categories, since there is still just one, and we still build the world with one (generic) kind of relation, composition.

(p.46) The problem with transitivity is also circumvented, for although each kind of parthood is transitive, transitivity does not apply across different *kinds* of parthood. Since the kind of parthood involved in qualitative parthood is different from the kind of parthood involved in spatiotemporal parthood (qualitative parthood is not extensional, and is defined using weak supplementation, while spatiotemporal parthood is extensional, and is defined using strong supplementation), the worry about transitivity simply fails to apply.

The view has appeal for those who like Lewis-style Humean mosaics, and indulges our corpuscular intuitions and our attraction to classical-mechanical or particle-based depictions of the world. If we understand fields in appropriately property-theoretic terms, the model can even capture Barry Loewer’s (2004) Humean supervenience-friendly account of the Lewisian mosaic, which Loewer designs in order to circumvent worries about quantum nonlocality for the fan of mosaic-style views. It’s worth noting that, understood this way, if we take clement nominalism and swap out primitively located and individuated trope-instances, replacing them with repeatable qualitative characters, and we define bundling in suitably mereological terms, clement nominalism collapses into the mosaic model.[24]

The mereological bundle theorist might further develop the mosaic model. One development goes fictionalist about spatiotemporal (or, alternatively, configuration-space) composition. The fictionalist denies the existence of any sort of equivalent of spatiotemporal composition after the level of the mosaic of located, unextended qualitative fusions distributed through a network of spatiotemporal relations. On this sort of (spatiotemporal compositional) fictionalist approach, one might describe what seems to be a table as “some qualitative fusions-arranged-tablewise.”

A very different way of developing mereological bundle theory, the *global* model, denies that strictly speaking, spatiotemporal composition is used to build the world. Instead, the extended world is wholly and immediately constructed from a fusion of n-adic properties, including spatiotemporal relations and perhaps a structuring lawlike relation, resulting in a distribution of properties across a spatiotemporal manifold. It is the whole, structured world that results from the original fusion of fundamental properties and relations. Although we can pick out portions of the manifold and describe them as “spatiotemporal parts” or imagine them as the products of the spatiotemporal composition of simples, all

of this is merely a useful fiction. The real parts of the world are the properties and relations that compose the extended world-whole, and here, parthood is transitive.[25]

On this sort of fictionalist approach towards spatiotemporal composition, one might describe what seems to be a spatiotemporal part of a table as "a portion of the qualitative world-fusion that is distributed table-top-wise." The fictionalism exactly parallels that of the compositional nihilist, except instead of taking the phrase "this table-top" to refer to a certain plurality of unextended simples arranged table-top-wise, it takes it to refer to a certain region of the world-whole. One might also look to **(p.47)** Horgan and Potrc (2009) for assistance with the semantics here.[26] Another alternative would be to adopt a version of Jonathan Schaffer's (2010) priority monism for spatiotemporal parts (not monism in general, since the world is still built from quality parts), taking spatiotemporal parts to be real but derivative. Here, again, we have two different kinds of parts, and so transitivity would fail to apply. Such a view has costs with regard to parsimony, but might be attractive overall: we just need to remember that classical extensional mereology is either derivative or just a handy toy model, and that the fundamental ontological basis for reality is a qualitative mereology.

The global model has more physical plausibility than one might initially think: consider the wave-function realist who takes the world-whole to be a wave function (Cf. Ney 2012). On the GRW theory of the world, the world is a universal wave function that evolves in accordance with the dynamical laws. Understood in terms of mereological bundle theory, the wave function is the fusion of amplitude and phase properties (along with any other properties of the system) with structuring properties or relations, including the structuring relations described by Schrödinger's equation and by the collapse postulate. A variant of this view can fit the Everettian approach, and one can also fit David Albert's 1996 treatment of Bohmian mechanics by adding a world-particle that is simply a fusion of properties to the plurality of things.[27] For this reason, I find the global model more appealing than the mosaic model. The empirical facts about the world, especially given facts about the existence of entangled states, just don't seem to support the sort of atomistic world that the mosaic view describes (although, admittedly, Loewer's model is consistent with these facts). However, the jury is still out on what the best fundamental physical theory will be, and so for some, at least for the moment, the mosaic model retains its appeal.

There is much more to say about a one category ontology of qualitative characters, but even more importantly, a standard objection must be addressed —one that has been pressed many times and in many forms, and one which many take to definitely refute bundle-theoretic ontologies. The objection concerns the way bundle theories should handle questions concerning the

identity and individuation of qualitative duplicates. It needs to be discussed in detail.

2.5 The Individuation of Qualitative Duplicates

The importance of the distinctions between bundle theories and other theories becomes clearer once we turn to questions about how objects are to be individuated. **(p.48)** The main issue for one category ontologists concerns counterexamples involving the possibility of qualitative duplicates. Substance theorists and substratum theorists individuate all objects, including duplicates, based on primitive differences founded on haecceities: primitive facts about the identity or difference of objects. For this reason, they can accommodate the possibility of qualitative duplicates.

Substance theorists, if they are willing to individuate at all, take concrete objects to be primitively individuated in terms of being primitively different substances. One way of cashing out this primitive difference is in terms of primitively different instantiation relations, such that objects are different instantiations of their proper kind in virtue of being primitively different substances that instantiate their sort property. Another way to cash out the differences between objects is in terms of primitively different individual essences or thisnesses, such that objects differ in virtue of having different thisness properties. For example, Adams (1979) distinguishes between individuals or particular things and their suchnesses, and takes particular things to be individuated by their thisnesses. In substance theory, however thisnesses are to be understood, it is important that thisnesses are not taken to be constituents of objects, since objects do not have deeper structure.

The method of individuation in substratum theory is similar in some ways to the method of the substance theorist: objects are individuated in virtue of primitive entities, in this case, substrata. As Sider points out, the substrata serve to primitively individuate the objects they are constituents of. “Distinct particulars…have distinct thin particulars, distinct non-universal ‘cores’” (2006: 387–8). The main difference between the method of individuation of substance theory and the method of individuation of substratum theory consists in whether the individuating entity is a constituent of the particular it individuates. For substratum theorists the entity is a constituent of its particular, for substance theorists it isn’t. In both approaches, however, the individuation is based on haecceitistic differences.

Endorsing haecceities, as I define it, involves endorsing the acceptance of some sort of in-principle empirically undetectable primitive entity, such as a substratum, or involves a broad commitment to primitive facts that determine identity and modal character, as with substance theory. The basis for this endorsement is a commitment to a version of the Principle of Sufficient Reason for identity claims: a commitment to the need for a ground for identities and

differences. As such, haecceitism holds that primitive facts are (and explain) the ultimate ontological sources of individuation and identity.

The way substratum and substance theorists individuate numerically distinct particulars is important, since advocates of both views claim that their views are superior to bundle theories on individuative grounds. The claim is that bundle theories cannot individuate numerically distinct indiscernible objects, and hence cannot accommodate a range of situations involving symmetries that we take to be pre-theoretically possible. For this reason, substance and substratum theorists argue that even though bundle theory may enjoy the advantage of one category parsimony, their theories do a better job of representing all the metaphysical possibilities.

But why think bundle theories can't individuate numerically distinct indiscernible objects? In brief, the objection based on indiscernible objects goes like this: a bundle theory holds that objects are simply collections of properties. But there could exist **(p.49)** numerically distinct objects that are fusions of the same properties, that is, there could exist numerically distinct but qualitatively indiscernible objects.

For example, consider world *W*. In *W*, all that exists are two perfectly homogeneous iron spheres that are two feet apart.[28] By supposition, the spheres are perfect duplicates, and they exist for exactly the same amount of time. Moreover, if we stipulate that the spheres exist in a spacetime such that locations in the spacetime are ontologically determined by which objects exist, then the spheres seem to share all of their fundamental extrinsic properties, and hence all of their extrinsic properties. (By stipulation, the extrinsic properties of having a certain location supervene in part on the identity or difference of the spheres.) *W* seems to be possible. Note that by granting the possibility of *W*, we take the spheres at different locations to be numerically distinct spheres rather than a single bi-located sphere.[29]

The objection is developed by considering the possibility of *W* in conjunction with the Principle of the Identity of Indiscernibles (PII). The PII claims that, necessarily, if *x* and *y* are indiscernible, *x* is identical to *y*. There are many ways to interpret the indiscernibility claim, and hence many interpretations of the PII. I will consider two interpretations of the indiscernibility of *x* and *y*:

(i) *x* and *y* share all their properties, including properties such as *being identical to x*.
(ii) *x* and *y* share all of their pure intrinsic and extrinsic properties.

Pure properties are defined as properties that are not based on any sort of primitive individuation of objects, i.e., they are not reducible, even in part, to any sort of primitive identity or difference. They include properties such as *being red, having a mass of 2kg*, etc. What pure properties exclude are primitive

identity-based properties like *beingthiscup, being Alex*, or *beingthat blue shirt*: these are *impure* properties.

The difference between interpretation (i) and interpretation (ii) captures the worry. All parties agree that, if indiscernibility is interpreted as (i), the PII is true. But what if indiscernibility is interpreted as (ii)? Is it true that, necessarily, if *x* and *y* share all of their pure intrinsic and extrinsic properties, *x* is identical to *y*? If *W* is possible, it seems that the PII under interpretation (ii) is not true.

The problem for bundle theory is that it is usually interpreted as entailing the truth of the PII under (ii). Now, why would bundle theory entail any such thing? To get the entailment, we need another premise, the Supervenience of Identity thesis: the property of *being identical to x* reductively supervenes on *x*'s pure (intrinsic and extrinsic) properties.

If the bundle theorist defends a pure bundle theory, and so holds that objects are simply collections of pure properties, it would seem that she must endorse the Supervenience of Identity thesis. And if she does, then the simple thought is that bundle theory is committed to saying that the PII under interpretation (ii) is true. **(p.50)** And this, many have thought, leads to disaster for the bundle theorist, since *W* seems to be metaphysically possible.

The problem can be intensified by recognizing that *W* merely illustrates a more general symmetry problem for the bundle theorist. Take any object which is perfectly geometrically symmetrical with respect to the pattern of instantiation of its pure properties. A two-dimensional object is intrinsically symmetrical in this way if it is possible to divide it such that its instantiation of its pure properties is mirrored with respect to an axis of symmetry, that is, it has two indistinguishable, numerically distinct "halves." (The properties instantiated at any two points lying on the perpendicular of this object at equal distances from the axis of symmetry are indistinguishable.) For example, imagine an object whose left side is a perfect pure duplicate of its right. The bundle theorist who accepts the Supervenience of Identity thesis is unable to accommodate the possibility of any such symmetries: not only is the bundle theorist unable to have a world like *W*, she is unable to grant the possibility of a world with a single, extended, perfectly symmetrical object. The perfectly symmetrical spheres of *W* collapse into a single point.

Now, there is an obvious rejoinder the bundle theorist can make to objections involving this sort of problem: reject the Supervenience of Identity thesis! There are two ways to do this. First, one could deny the thesis by accepting haecceities or impure properties as constituents of bundles. The substance theorist and the substratum theorist, in effect, deny the truth of the Supervenience of Identity in virtue of their endorsement of haecceitism, and the bundle theorist could follow their lead.

But, second, one could follow the lead of the austere nominalist and deny the Supervenience of Identity, while also rejecting any need for haecceities to perform the individuative task. The austere nominalist simply holds that the thesis is false. It is not “made false” by the existence of any primitive impure property, relation, or substratum. Rather, identity facts simply supervene on the objects themselves: i.e., the identity of *x* supervenes on *x*, and that’s all. The spheres of *W* are different. That’s it. This move is simple, clean, and effective. It requires a kind of primitive individuation, but one which is ungrounded in primitive facts. Call this sort of primitive difference an “ungrounded difference.” (It amounts to a denial of any version of the principle of sufficient reason that requires identity explanations.)

A version of the same move is made by the trope bundle theorist when she embraces primitively individuated tropes, i.e., clement nominalism. According to the (standard) trope bundle theorist, tropes are simply different, and this difference does not supervene on any additional facts or properties. So tropes are distinguished in virtue of ungrounded differences. Hence, trope bundle theory can accommodate the possibility of *W* by holding that the tropes of each sphere are primitively different, so the spheres are different objects. (Properties are sets of primitively resembling tropes, so in the relevant sense the spheres can be said to include the same properties even while they do not include the same tropes.)

But if the trope theorist and the austere nominalist can accommodate *W*, why can’t the Russellian bundle theorist, even the Russellian who endorses transcendent universals? As it turns out, the Russellian bundle theorist *can* accommodate *W* (*contra* Benovsky 2008). Like the others, all she has to do is reject the Supervenience of Identity thesis. I recommend that she do so by denying the PSR and accepting **(p.51)** ungrounded differences. On such a view, objects are constituted by nothing more than compresent universals, but there can still be numerically distinct objects that are bundles of the same properties. The objects are different, but not in virtue of differences between their properties. Hence, in *W*, the spheres are different, but not because of any primitive fact, property, or haecceity: they are *barely* different. A variant on this view primitively individuates the primitive relations of compresence that bundle the universals, on much the same model as the individuation of tropes.

Mereological bundle theory can follow the same lead. On the mosaic model of mereological bundle theory, perhaps the fusions (the wholes) are barely different. After all, she has already denied mereological extensionality. Or perhaps the fusion relations are barely different, on the model of the difference between tropes. On the global model of mereological bundle theory, we might brutely distinguish qualitatively symmetrical portions of the world-whole.

In any case, endorsing ungrounded differences allows the bundle theorist, whether traditional or mereological, to accommodate the possibility of a purely symmetrical universe. I find the move to reject the Supervenience of Identity thesis particularly appropriate in the case of the Russellian bundle theorist and the mereological bundle theorist, for they can then combine their reductive treatment of property resemblance (resemblance is explained in terms of sameness of properties) with the possibilities for symmetry that we find intuitively plausible. (This move would allow the Russellian to rebuff the arguments presented in Hawthorne and Sider (2002).)

Now that we've seen how attractive ungrounded differences (or "bare differences") can be, it's worth taking a little space to discuss a version of one option in particular that I mentioned above, the one where one accepts impure properties or relations as constituents of bundles. The move is relatively neglected, yet it has a distinguished pedigree (e.g., we find it in Scotus) and there seem to be independent reasons why one might find such a view plausible. I myself don't want to endorse the move, but it is interesting. The sorts of impure properties I have in mind would be derived from *ungrounded* primitive differences between objects' *de re* modal properties. (A more traditional move would be to derive *de re* modal properties from primitive facts or thisnesses.) One might hold that instances of *de re* modal properties are based on bare differences.

Depending on one's metaphysics of modality, such an individuation is not nearly so ontologically heavy-duty as it might seem. For instance, one might hold that instances of *de re* modal properties are individuated in the way other tropes are: instances of being essentially such-and-such or accidentally so-and-so may primitively resemble each other, yet remain numerically distinct. But even without a trope-theoretic individuation (one might not like tropes), in the context of contemporary reductionist, ersatzist accounts of *de re* modality, the ontological cost of this move is very low. It is hard to get wound up about primitive differences between variables and the like needed to ontologically distinguish representations, yet this is all the bundle theorist needs to capture the postulated *de re* difference between indiscernibles.

Let me expand on this point a little. To make this move, I am assuming a certain view of *de re* modality: an ersatzist treatment of *de re* modal properties in terms of representation by abstract possibilia. On ersatzist accounts of *de re* modality, *de re* **(p.52)** modal properties are reduced to ontologically thinner properties of being represented in certain ways by abstract entities, such as sets of propositions. (Lest anyone think that ersatzism requires antirealism about essence, note that it is perfectly possible for a dyed-in-the-wool essentialist to be an ersatzist and a fan of counterpart theory. See my (2006b).) To individuate *de re* modal properties, we simply need to primitively individuate the representing done by abstract entities by allowing an abstract entity to represent a pure

situation *twice over*, i.e., to represent that there are two copies of a pure situation. A way to do this as a linguistic ersatzer would be to represent that the things represented are different by representing worlds quantificationally.[30]

To understand the intuitive motivation behind making primitive distinctions between *de re* representations of purely indiscernible situations, consider Saul Kripke's famous defense of primitive distinctions between representations of possibility:

> Two ordinary dice, (call them die A and die B) are thrown, displaying two numbers face up. For each die, there are six possible results. Hence there are thirty-six possible states of the pair of dice, as far as the numbers shown face-up are concerned, though only one of these states corresponds to the way the dice actually will come out…The thirty-six possibilities, the one that is actual included, are (abstract) *states* of the dice, not complex physical entities.… 'How do we know, in the state where die A is six and die B is five, whether it is A or B which is six? Don't we need a "criterion of transstate identity" to identify the die with a six—not the die with a five—with our die A?' The answer is, of course, that the state (die A, 6; die B, 5) is *given* as such (and distinguished from the state (die B, 6, Die A, 5).)…The 'possibilities' simply are not given purely qualitatively (as in: one die, 6, the other, 5). If they had been, there would have been just twenty-one distinct possibilities, not thirty-six…Nor, when we regard such qualitatively identical states as (A, 6; B, 5) and (A, 5; B, 6) as distinct, need we suppose that A and B are qualitatively distinct in some other respect, say, color. On the contrary, for the purposes of the probability problem, the numerical face shown is thought of as if it were the only property of each die. Finally, in setting up this innocent little exercise regarding the fall of the dice, with possibilities that are not described purely qualitatively, we make no obscure metaphysical commitment to dice as "bare particulars," whatever that might mean. (1980: 16–18)

Kripke's example brings out two points relevant to our discussion. First, it supports the general point that ungrounded distinctions can make perfect intuitive sense: I think we make ungrounded distinctions all the time when we make judgments about probability, and we do not need haecceities in the form of bare particulars, primitive thisnesses, or other ontological injections in order to do so.[31] There's no primitive *thing* that the difference in possibilities must supervene upon. The possibilities are simply barely different. Second, more specifically, it is intuitively natural to primitively distinguish between the states or representations of possibility provided by possible outcomes of rolls of the dice even if we cannot *purely* distinguish between the two different situations of an outcome of (A, 6; B, 5) and an outcome of **(p.53)** (A, 5; B, 6). I conclude that

there are clear, intuitively plausible ways of primitively individuating *de re* properties without heavy-duty ontological machinery.

All of this suggests that the primary ontological choice one must make, given the seeming possibilities of various sorts of pure symmetries, is not between ontologies but between whether or not we accommodate the possibility of these symmetries. Only if one chooses to accommodate the possibilities must one then choose between ontologies: between a universe with primitive grounded differences and a multiplicity of categories, or a universe with primitive ungrounded differences and a single category. In any case, if we assume that an intuitively appealing ontology requires the accommodation of the possibilities of deeply pure symmetries, we need to reject the Supervenience of Identity thesis.

Although many find the rejection of the Supervenience of Identity thesis and the endorsement of ungrounded differences intuitively permissible, it is not without cost to the bundle theorist. For what is the advantage of being a bundle theorist if one endorses ungrounded difference? The worry comes to the following point: once one endorses ungrounded differences, the appeal of bundle theory is lost, because it has lost its purity. This objection has two parts. First, a universe of infinitely many primitive differences gives us a messier ontology; a messier structure for reality. I don’t find this part of the objection especially worrying. After all, if one accepts the intuitions about differences, it reflects strong intuitions one has about the objects and possibilities of this and other worlds. If we think our intuitions capture the ontological facts, then we should endorse the structure they support. Moreover, substance theorists and substratum theorists, and trope theorists of all varieties, already endorse the existence of this sort of structure, albeit for independent reasons. The bundle theorist simply joins the club in the ontological red-light district.

The second part of the objection is much more pressing, and I think it goes to the root of why some are unimpressed by a bundle theory with ungrounded differences. This part of the objection points out that it is no longer clear that a bundle theory with ungrounded differences retains any overall ontological or categorical advantage over substance theory or substratum theory. The thought is that the loss of purity collapses the most obvious differences between bundle theory and its competitors.

The worry has some bite if one is a traditional bundle theorist, whether trope-theoretic or Russellian. What are the differences between such a bundle theorist and the substratum theorist? As we have seen, neither takes properties to be literally parts of objects. Both endorse primitive individuation: the substratum theorist endorses primitive differences grounded by substrata, while the bundle theorist endorses ungrounded differences or differences grounded by thisnesses as constituents of the bundle. Bundle theorists defend primitive bundling relations such as compresence, while substratum theorists defend primitive

substrata. Bundle theorists might argue that their ungrounded primitivism is ontologically more minimalist than their competitors' haecceitism, but the differences here seem rather small, even if they are not quite terminological (Sider 2006, Benovsky 2010). Moreover, the substratum theorist can argue that his view does a better job of accommodating the intuition that properties need a bearer. Strictly speaking, because substratum theory distinguishes between properties and their bearers, while bundle theory does not, substratum theory is a an explicitly two category ontology while traditional bundle theory claims to be a one **(p.54)** category ontology, but this is the only real point of difference between the two views, and as I argued above, I'm inclined to hold that traditional bundle theory is a two category ontology for other reasons (also see van Inwagen 2011).

But the mereological bundle theorist who accepts ungrounded individuation escapes this problem virtually unscathed. She takes properties to be literally parts of objects, and replaces bundling with a simpler, more familiar mereology of properties. (More simple and more familiar because it is defined using our antecedent understanding of "part.") She denies any distinction between property and object, and builds this denial into the foundation of her theory, thus retaining a significant measure of the simplicity of her one category view, even if her mereology involves the denial of the uniqueness of composition. Thus, if the Supervenience of Identity thesis is rejected, the real ontological differences are between the mereological bundle theory on the one hand and the substratum and traditional bundle theorists on the other.

I've been assuming that the possibilities of symmetry need to be addressed in one's ontology. But what if one thinks that we live in a fundamentally pure universe, one where perfectly symmetric qualitative duplication does not occur? Call this sort of person an "empiricist." I find the appeal of the spareness and simplicity of such a system, especially when coupled with mereological bundle theory, appealing.[32] (Not when applied to the case of asymmetric relations, since such relations impose qualitative asymmetry on a universe in virtue of their intrinsic character.) If we want to preserve this purity and simplicity, we have two choices. We can endorse the PII under interpretation (ii). Or we can reject the idea that a single ontology must suffice for all possibilities, and endorse a contingent version of pure bundle theory. On this view, it's not *analytic* that "object" must pick out a bundle of properties. Other worlds may have other ontologies. It's just that pure mereological bundle theory is the best theory of what objects are in the actual world, and worlds very like ours in the relevant senses. This view either holds that the actual world contains no perfect symmetries across locations, and so is not threatened by *W*-like cases, or holds that including the right sort of spacetime in one's ontology can accommodate all actual symmetries. I find either option appealing. Personally, since I think metaphysical reasoning involves the construction of models, and the acceptance of a metaphysical model as true is based partly on a posteriori reasoning

involving inference to the best explanation, I prefer the contingent ontological option. So officially, I defend a contingent version of pure mereological bundle theory. Those who find even the mere possibility of primitive individuation abhorrent will prefer to embrace the PII.

2.6 Indiscernible Particles in Quantum Mechanics

Either view is plausible, except for one wrinkle: an objection concerning a widely accepted empirical possibility of having multiple, purely indiscernible elementary **(p.55)** particles at the very same spatiotemporal location.[33] Call this the *haecceitist objection*. According to this objection, empiricists must recognize and accommodate the real-world fact of the existence of systems consisting of two or more purely indistinguishable elementary particles, such as 2-boson states, and this fact blocks both of the empiricists' options.[34] Now, one might flat-out deny that, given contemporary physics, we should even countenance the idea of anything like purely indiscernible elementary particles, but let's set this option aside for the purpose of the argument.

The haecceitist objection, restated, goes like this: it is a widely accepted empirical truth that in the actual world there can exist states such that two or more perfectly purely indistinguishable bosons occupy the very same location. In order to accommodate this truth, the objection goes, we must individuate the bosons impurely, for there are two of them, they have the same location, and they are purely indistinguishable. The objection claims that the actual-world case both entails that the PII is false and refutes the contingent empiricist's pure bundle theory. In other words, the objection claims that the empirical facts support haecceitism, or at the very least, primitive individuation of some sort, and disprove the possibility of the purity of the actual world.[35]

Or so one might think, if one is insufficiently clear about the metaphysical import of the standard interpretation (the "Received View") of these quantum systems. Let's look at the facts concerning these systems according to the Received View about them. As will become clear, the possibility of multiple, purely indiscernible elementary particles poses no threat to the empiricist.

The decisive point is that, contrary to the assumptions behind the haecceitist objection, the Received View of states involving indiscernible elementary particles *removes* any basis for an argument for haecceitism. The Received View is that, ontologically, the particles are not distinct entities, so no haecceities are needed to distinguish "them." The basis for this conclusion is the collection of empirical facts derived from a standard interpretation of quantum statistics. According to this interpretation of quantum statistics, facts about permutation invariance show us it is wrong to think of quantum states, such as 2-boson states, as involving multiple indiscernible bosons, even if they are usually described as "2-boson states" or as "states involving multiple indiscernible particles." This is because such quantum states are "permutation invariant."

What this means is that the distribution of the objective probabilities of the ways the states can occur refutes the possibility that, for example, a 2-boson state is composed of two indiscernible bosons.

It's worth saying a little more about how permutation invariance should be understood. The idea is that it is ontologically (not merely epistemically) pointless to try to permute the so-called indistinguishable particles in order to count, say, a situation where particle A is in state S1 and particle B is in state S2 as different from **(p.56)** a situation where B is in S2 and A is in S1. There is no ontological difference between these situations: they are the same situation. The quantum statistical distribution of the probabilities of the occurrence of the various ontologically possible situations reflects this fact.

The thought is that, if there really were two particles, A and B, composing the "two-particle" system, then they would be permutable, i.e., there would be four different possible (and equiprobable) configurations. But the quantum statistical facts do not support permutability: there are only three possible (equiprobable) configurations. So the quantum statistics show us a fact about the ontology of these states: it shows us that there is no ontological difference between the state where particle A is in S1 and particle B is in S2 and the state where particle B is in S1 and particle A is in S2. The Received View then imposes an interpretation that makes sense of this: since there are no swappable (permutable) parts, the n-particle state is not composed of numerically distinct particles after all. Such states are composed some other way, which is suggested by their interesting, perhaps peculiar, lack of quantitative structure. Although we use the phrase "2-boson-state" to refer to the state or system in question, the state does not have the sort of structure that the name suggests: in particular, it does not have internal quantitative structure involving multiple repeating "particle units."

So the Received View is that since there is no way to permute the "1-particle parts" of a "2-particle" system, it is not divisible into 1-particle parts. A standard, but linguistically unfortunate, way this claim is made is by saying that the indiscernible particles, such as the two bosons of a 2-boson state, are "not individuals," are "not objects," or "lack individuality" or "lose their identity."

Metaphysicians must understand such claims in the correct way. Clearly, "objects" here does not mean what metaphysicians often mean by "objects." By their claim that quantum particles are not objects, fans of the Received View mean only that quantum particles do not physically resemble tiny billiard balls or atoms; or that whatever the right ontology is here, to think of quantum particles under an atomistic conception is mistaken. Quantum particles are not small, physically and spatiotemporally discrete entities that we can count or measure; in this sense, they are fundamentally unlike material objects, or unlike what we can call "thick objects." Although the quantum mechanical description of the ontology, at least initially, involves talk of "particles" and of "states," and

of, say, “2-particle” or “3-particle” states, this description is fundamentally misleading because it suggests the atomistic or ordinary conception of objecthood. Whatever we are picking out by the phrase “quantum particle,” it is not anything even remotely similar to what we ordinarily take a material object to be. Hence, the standard way we use language to talk about “quantum particles” is misleading, presumably as the result of our pre-theoretical or classical physics-based conceptual stance. What the quantum statistics show is that this conceptual stance must be revised.

But if a 2-boson system is not divisible into two 1-particle parts, then what is it? How can it make sense to postulate a partless entity of this sort?[36] A natural way to **(p.57)** understand the Received View, based on the approach taken by Erwin Schrödinger, takes these sorts of quantum states as being, fundamentally, instantiations of *properties*.[37] Even though we speak of particles at the quantum level, such talk does not refer to atom-like bits of matter whizzing around the void, or anything remotely like this. We are simply referring to instantiations of fundamental properties in our talk of n-particle systems. Such properties may or may not include instances of having certain masses, locations, or forces, but we do not need a thick atom-like object to “have” these properties for them to be instantiated.

We can take the property instances to be excitation strengths (“field excitations”), or something very like. So a 2-boson state is just a field with an excitation strength of, say, 2b. (Determining exactly what the 2b property is is one of the jobs of physics.) This is how I interpret the Received View, and I believe this is how we should understand comments like those of Saunders (2006): “We went wrong in thinking the excitation numbers of the mode, because differing by integers, represented a count of things; the real things are the modes” (p. 60).[38]

Now, this interpretation is mysterious in a certain way, because it opens up ontological possibilities that do not seem to have been sufficiently appreciated. What is mysterious is not that the fundamental entities are property instances. The mystery attaches to the way we are inclined to think of the nature of these property instances, which are what Armstrong labeled “fundamentally intensive properties.” We are used to thinking of many types of properties as unstructured in a certain sense; for example, the property of *being sweet* seems to lack internal structure. But we are also used to thinking of other sorts of properties as having internal structure, especially properties involving quantities, like having a mass of 2kg, or for that matter, having a field excitation strength of 2b. We are inclined to think that properties involving such quantities are constructed, somehow, from more fundamental quantities; perhaps unit quantities (although what exactly those unit quantities might be is a matter of mystery). Having a mass of 2kg reductively supervenes upon having two instances of having a mass of 1kg, and so on. But the possibility of irreducibly

intensive properties of quantity means that, at the very least, not all properties of quantity are constructed this way. (Maybe none are.) Armstrong (1997: 65) hoped that there were no irreducibly intensive properties of quantity, since they create difficulties for his conception of universals.

The interpretation of the Received View entails that Armstrong is out of luck: there are such intensives, for example, the property of 2-boson-ness. The mystery we are left with is how to develop a metaphysics of irreducibly intensive properties, which is a problem that metaphysicians seem to have been ignoring. The obvious patch is to accept that there may be more fundamental properties than we might have thought there were. In any case, the relevant point is that the irreducibly intensive properties of these quantum states are internally unstructured in that they are not reducible to conjunctions or co-instantiations of multiple instances of unit quantities such as *being a boson* or *being boson A*. In other words, the intensive properties of the quantum states we have been considering, like that of 2-boson-ness, are ontologically **(p.58)** basic. For example, the property of 3-boson-ness is ontologically basic, and so is not constructed from 2-boson-ness and 1-boson-ness, or from a state of affairs involving three indiscernible “atomistic” bosons. The advantage of moving to an interpretation of a 2-boson state as an instantiation of 2-boson-ness is that, to many, it is much more plausible to admit some irreducibly intensive properties into one’s ontology than to admit, say, partless extended simples.

The bundle theoretic view, given the Received View, follows the standard interpretation and holds that systems of indiscernible quantum particles are states that are instances of irreducibly intensive properties. (Of course, according to the mereological bundle theorist, these are objects.) The proposal that property instances are the fundamental quantum-mechanical entities can also characterize states in which there is no definite number of particles or a superposition of particles, and where such states or modes are representation-dependent.[39] In such cases, the property instances or states reflect the indeterminacy we find in the world. The property instances here are relational or structural properties of having a certain (incomplete) structure that can be represented in different ways.

Now that we have the Received View in hand, the consequences of the empirical facts for the empiricist who desires a pure universe are obvious. Those who endorse the PII can argue that n-boson states are not counterexamples to their list of what is possible.[40] Correspondingly, those who have independent reasons to endorse a contingent pure ontology can argue that n-boson states are not counterexamples to their claim that a pure bundle theory gives the best (i.e., true) model of the actual world.[41] For those who want to defend the view that claims supporting one category ontologies are necessary truths, they might respond to the possibilities involving symmetrical worlds by claiming that such

symmetries involve single instantiations of irreducibly intensive properties, not multiple instantiations of the same properties.

There is a further way, perhaps, in which the Received View supports mereological bundle theory, for it provides a way to understand and motivate reasons for defending the view that there is no ontological difference between properties and objects. Just to be clear: one can understand the Received View that quantum states are fundamentally intensive property instantiations in a way that is consistent with many different ontologies. Traditional bundle theories can endorse irreducibly intensive properties just like mereological bundle theorists can. Substratum theorists can take the field to be the bearer of the irreducibly intensive property, austere nominalists can perhaps take a field to be an object in some sense and classify fields differently depending on excitation strengths, etc. Substance theorists can take the field to be an unstructured object standing in relations to irreducibly intensive universals.

(p.59) But there may be a more subtle way in which the interpretation of the Received View supports mereological bundle theory. To see this, recall that the key move of the interpretation is conceptual: it tells us that our knee-jerk way of thinking about the things physicists describe as “objects” or “particles” as little material-like hunks of stuff is fundamentally mistaken. We knew this already from quantum mechanics, but the ontology of elementary boson states sharpens the need for ontological precision. The case gives us a straightforward example of a situation where, for empirical reasons, we must reconceive our approach to particle-talk and think in terms of properties, not substances, with regard to talk of objects like particles. As such, we have a nice, clear case of how it is possible and desirable to make the conceptual move from substance to property in a particular case. Such a good example of collapsing the artificial distinction between property and object—and making the fundamental entities more property-like—lends support to the legitimacy of making this move in the ontology of the mereological bundle theorist.[42] Anybody who claims that such a move involves some sort of category mistake or that it is unintelligible needs to defend that claim using more than knee-jerk reflections. Moreover, the existence of properties such as 2-boson-ness provides examples of actual properties that are concrete or can exist independently, *contra* Simons and others’ claims about the dependency of properties.

My personal preference is for a contingent, pure mereological bundle theory where all things, including locations, are constructed from fusions of n-adic properties. As stated, my view endorses the empiricist stance I described above: unless there is some further empirical reason to make primitive distinctions, the simplicity and purity of pure bundle theory should be preserved. However, even if we need to move to a bundle theory that delimits the symmetrical possibilities by embracing ungrounded differences, there is still a clear metaphysical advantage to embracing the one category ontology that my mereological bundle

theory gives us, as we retain the clear distinction between bundle theory and substratum theory that traditional bundle theorists lose. There is no need to look to any other ontology.

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Notes:

([1]) I take Sider’s (2012) view to be, in part, the view that the fundamental quantificational structure of the world is such that there is only one category of being, as opposed to, say, the view that there are many ways of existing and hence many categories of being. The fact that there is only one most natural interpretation of the quantifier is the fact that there is only one fundamental way to exist, only one realm of being, and no categorical distinctions corresponding to different ways of being. See McDaniel (2009) and Turner (2010) for an explication of how to understand the connection between quantifier variance and ontological pluralism.

([2]) I accept relationalism about spacetime, on broadly empirical grounds.

([3]) See Sider (2012) for discussion of adding to one’s ideology instead of one’s ontology.

([4]) See van Inwagen (2011) for the division between primary (or fundamental) categories and secondary, tertiary, etc. categories.

([5]) Van Inwagen (2011) provides an excellent account and justification of such a view.

([6]) See Wolterstorff (1970) for the distinction between relational and constituent ontologies.

([7]) To their credit, Keith Campbell (1990) and John Bacon (1995) do not seem to make these sharp ontological distinctions between object and property (although

they make problematic categorical distinctions elsewhere), and they are also clear that their bundling relations are non-mereological.

([8]) But see van Inwagen (2011) for an argument that this construction is unsuccessful.

([9]) Fine (2000a) argues that there are certain sorts of counterexamples to the principle that no more than one kind of object can occupy a particular place.

([10]) I'm not quite sure how electrons and other fundamental particles get classed as "concrete particulars," since they aren't really very concrete, but I think the austere nominalist usually wants to include them in his ontology.

([11]) Thus, I agree with Simons's insightful comment: "If this is all there essentially is to the part-relation, why can stronger principles sometimes apply? The answer lies not in the part-relation itself but in the nature of the objects to which it applies" (Simons 1987: 363).

([12]) I suspect that qualitative parts are the only parts there are, but I include the designation here for clarity. Note that haecceitistic and other impure properties can still be qualitative parts as I am using "qualitative" and that the fusion relation is the composition relation.

([13]) Cf. Markosian (1998).

([14]) Note that since qualitative fusion may be restricted we have the resources to make sense of cases where proper qualitative parts P, Q, and R are qualitatively fused together but there is no fusion of P and R, and so no object that includes P and R. Imagine an object O that includes *red, round*, and *squashed* in its fusion. Is there an object that is simply round and squashed? If so, then we grant that there can exist incomplete objects, perhaps as long as such objects are part of a complete object. If not, then this is an instance of restricted fusion.

([15]) Related issues are taken up in Fine (2000b).

([16]) I recently discovered one exception to this rule: McDaniel (2001).

([17]) Or at least, no obvious difference. I have to admit that I'm kind of partial to being a dogmatist, Pryor-style, about our knowledge of composition. But that's a different discussion.

([18]) Also see Schaffer (2003).

([19]) This supports the point made in van Inwagen (draft ms.) but from a different angle.

([20]) Only a bundle theorist like Campbell, who is the clearest about the concrete nature of tropes and takes the bundling relation to be a primitive new relation of compresence can escape this charge.

([21]) Jason Turner (2011: 15).

([22]) Baker (2011), Paul (2013).

([23]) The mosaic model also makes very good sense of Goodman (1966), who takes qualitative parts to be appearances of spatiotemporally located trope-like entities or patches of the overall phenomenological quilt and builds a mereology of appearances in the spatiotemporal manifold.

([24]) Such a swap might be prohibited for the true nominalist: Loux (1998) defines the nominalist as one who denies the existence of universals or multiply repeatable qualities.

([25]) I think this view has interesting connections to the holistic view Dasgupta's (2009) describes as "generalism"—although my view is still atomistic in his sense.

([26]) Horgan and Portc (2009) defend the view that the world has no proper spatiotemporal parts and develop a contextual semantics intended to accommodate our ordinary ways of speaking.

([27]) We can extend the global model in a way that is parallel to the first way we extended our first model of mereological bundle theory. Instead of holding that there is only a single world-whole, or (as in the first model) holding that there are many unextended fundamental qualitative fusions of the world, we might hold that there are some or many *extended* fundamental qualitative fusions, where such fusions are arranged as a mere plurality, that is, they do not spatiotemporally compose into a larger whole. If our world is like this, then the fundamental entities are extended qualitative fusions (perhaps they are the "spacetime states" of Wallace and Timpson (2009) or successive stages of the "world particle" of Albert (1996)).

([28]) Max Black (1952: 153–64) describes an example like this one as part of his discussion of the individuation of objects.

([29]) Cover and (O'Leary-) Hawthorne (1998). It's also important to note that the problem with symmetry and location is not confined to worlds like *W*: as Hawthorne and Sider (2002) show, there are many permutations of objects that can create trouble for bundle theory. The solutions to the problem of *W* can be applied, *mutatis mutandis*, to these other problems.

([30]) I am basically suggesting we follow Daniel Nolan's (2002) ersatzist strategy for distinguishing alien universals. Also see Sider (2002).

([31]) Kripke's discussion doesn't specify whether he thinks the primitive individuation has to be ungrounded. I don't think his example requires ungrounded primitive individuation to work, but it does show how thinking of primitive individuation in this way makes good intuitive sense.

([32]) Dasgupta (2009) argues for the view that there are no *primitively individuated* individuals. This is not quite the claim that there are no primitive individuals, nor is it the same as the claim that there is no categorical difference between individuals and properties. However, his view indirectly supports a one category ontology by undermining arguments that claim to have empirical support for ontologies that include primitively individuated individuals.

([33]) Della Rocca (2005) discusses an interesting variant of this possibility.

([34]) I'm ignoring options that involve moves like primitively individuating spatiotemporal locations or primitively individuating instantiations of properties, since these are in effect impure solutions that such an empiricist would reject.

([35]) Dasgupta (2009) disputes this, arguing that there is no possible empirical support for *primitively individuated* individuals or bearers of properties and relations.

([36]) Under some sort of physically nonstandard interpretation, this could connect up to the possibility of extended simples.

([37]) See Teller (1983).

([38]) Also see Teller (1983) and Schaffer (2001).

([39]) I'm indebted to Richard Healey for pointing out that I need to address this issue.

([40]) The solution incorporating intensive properties may also be relevant to Della Rocca's (2005) discussion.

([41]) In fact, it seems to me that if one rejects the idea that the world is built from spatiotemporal parts, and also takes the world to be a fusion of properties, with its structure determined by structural properties, symmetry worries don't even arise, since the world gets its structure from the structural property fused with other properties, not from building up from smaller mixes of properties. Thus, mereological bundle theory may avoid symmetry problems outright, since it does not build the world spatiotemporal hunk by spatiotemporal hunk.

([42]) The collapse of the distinction may also favor the austere nominalist, who could interpret the Received View to endorse entities such as structureless 2-boson simples. I don't think this is the usual way the philosophers of physics are

inclined to think of the situation, but it is coherent. See Katherine Hawley (2009) for related discussion.