Physicalism and the Sortalist Conception of Objects

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1. Introduction

Many contemporary philosophers hold an Aristotelian metaphysic of objects, which, for reasons that will become clear shortly, I will call 'sortalism'.[1] According to sortalism each object belongs to or instantiates a kind (or sort) that best expresses what that object is, which in turn determines which changes it can and cannot survive (namely, the changes characteristic of the sort). A representative statement is given by Baker (2002, p. 372), who affirms

> an Aristotelian assumption. For any x, we can ask: What most fundamentally is x? The answer will be what I will call x's 'primary kind'. Everything that exists is of exactly one primary kind- e.g. a horse or a passport or a cabbage. A thing's primary kind determines its persistence conditions. And since its primary kind property determines what a thing most fundamentally is, a thing has its primary kind property essentially: it could not exist without having its primary kind property.

Going forward my terminology will differ, however, largely because 'kind' is often used indifferently between kinds of objects, such as *horse* or *cabbage*, and (kinds of) attributes such as *color* or *shape*. (The distinction is important, as it harkens back to Aristotle's notion of "secondary substance"; more on this shortly.) Instead, I will use 'sortal' for a kind of object, and 'sortal identity' for an individual object's being an instance of, or instantiating, the "primary" sortal that uniquely captures "what a thing most fundamentally is", as Baker puts it. I will call 'sortal properties' those properties that are determined by something's sortal identity, such as its persistence conditions.[2] (Thus, if *statue* is a "primary" sortal, an individual's being a statue is its sortal identity, and its inability to survive being smashed is a sortal property.) Lastly, I will use 'sortalism' for the package view that objects have sortal identities and properties as a result;

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[1] The Aristotelian view was revived by Wiggins (1967; 2001), and then defended by Baker (2002), Fine (2003; 2008), Lowe (2006; 2007; *inter alia*), and Koslicki (2004; 2008), among others.

[2] See Fine (1995), Zalta (2006), and Correia (2012) for discussion of the consequence relation.

according to sortalism each object belongs to or instantiates a sortal that best expresses what that object is, which in turn determines the changes it can and cannot survive.

Physicalism—the doctrine that everything is physical—is another popular metaphysical view.[3] How are physicalism and sortalism related? *Prima facie* there is no inconsistency. Sortalism may even seem like a candidate for a metaphysic of material or physical objects.[4] Yet the appearance is misleading: in this paper I will argue that physicalism is incompatible with sortalism. My argument runs as follows.

P1. Something is physical only if it is physically fundamental or is determined by what is physically fundamental.

P2. Sortal identities and properties are not physically fundamental.

P3. Sortal identities and properties are underdetermined by what is physically fundamental.

C1. Therefore sortal identities and properties are not physical.

Assuming the argument valid, the crux, naturally, is soundness. My defense works as follows. I argue for P1 by showing the criterion of physicality it expresses falls out of a standard conception of physicalism. The argument for P2 is that taking sortal identities and properties to be fundamental is tantamount to positing Aristotelian substantial forms and concomitant formal causes- which are themselves incompatible with physicalism. My defense of P3 involves canvassing solutions to "the grounding problem", which is the problem of showing how (nonfundamental) sortal identities and properties are determined by—or grounded in—(nonsortal) physical properties. In particular I argue that extant solutions are physicalistically unacceptable or else physicalistically acceptable solutions jettison the sortalist metaphysic. As

[3] Traditionally 'everything' is taken to be unrestricted, though some might wish to exclude *abstracta*. I won't because, as I explain in §2, my goal in this paper concerns physicalism as it is traditionally understood. Nothing in my argument turns on this point, however, so one may restrict as one wishes.
[4] See especially Ellis (2001; 2002) and Devitt (2008).

sortal identities and properties are neither physically fundamental (P2) nor determined by what is physically fundamental (P3), I conclude that sortal identities and properties are not physical; physicalism is incompatible with sortalism.

2. P1: Fundamentality, determination, and physicality

P1 provides a necessary condition for being physical: something is physical only if it is physically fundamental or is determined by what is physically fundamental.[5] This conception of physicality is orthodox, and I intend my thesis (that sortalism is incompatible with physicalism) to concern physicalism as it is traditionally understood.[6] So my goal in this section is simply to flesh out P1—rather than defend it against rivals—such that my subsequent arguments for P2 and P3 are properly situated. Towards that end I will clarify i) what it is to be *fundamental*, ii) what it is to be *physically* fundamental, and iii) why what's nonfundamental is physical only if it is *determined by* what is physically fundamental.

What is it to be fundamental? The intuitive idea is being primary, basic, or bedrock. Of course metaphysicians have proposed more fleshed out accounts. Space forbids any in-depth investigation of these, however, and as just noted my aim here is to work with a traditional conception of physicalism rather than defend one as philosophically best. So I will do the same for fundamentality and simply flag my assumptions. I will understand fundamentality as a lack of determination. The basic idea of determination is simple and familiar: determination is an *in virtue of* relation, i.e., a relation of *bringing about* or *being responsible for* (Audi 2012, p. 690). Determination is thus a relation of ontological priority: if x determines, is responsible for, or brings about y, then

[5] Because sortal identities and properties do not satisfy this necessary condition (or so I will argue), sufficiency conditions for physicality are not germane here.

[6] See Hellman and Thompson (1975) for a classic expression of this view, and Kim (1982), Crane (1991), Wilson (1999), Loewer (2001) for elaboration and defense. For criticism see Montero (1999; 2006).

x is ontologically prior to y. Because fundamentality involves being primary or basic, something is fundamental only if there is nothing ontologically prior to it. It follows that if some y is determined by some x—if some y exists or obtains in virtue or because of some x—then y is not fundamental. Conversely, some x is fundamental only if nothing determines it.[7]

I will assume determination is asymmetric and transitive. What other logical properties determination may have I will leave open (at least for now). Determination does have an important nonlogical property that must be emphasized here, however: determination is an explanatory relation in the robust sense of 'metaphysical explanation' made popular by Fine (2012), *inter alia*. Niceties aside, the basic idea is that if some set of facts (e.g. the chemical facts) determines some other set of facts (e.g. the biological facts) then the former (metaphysically) explains the latter. This of course renders determination sufficient for (metaphysical) explanation. I also take determination to be necessary for metaphysical explanation (even if determination is not necessary for everyday or pragmatic explanations, which likely have looser standards). If chemical facts do not determine biological facts, for example, then biological facts are not metaphysically explained by the chemical facts. It follows that fundamentality requires metaphysical inexplicability. Because something is fundamental only if it is not determined, and a lack of determination entails a lack of (metaphysical) explanation, then something fundamental is metaphysically inexplicable. This coheres with the intuitive senses of these terms: after all, if something is fundamental there is nothing more basic or fundamental that could explain it.

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[7] Many now understand fundamentality in terms of "grounding", a relation appearing quite similar to what I've said about determination: Schaffer (2009), for instance, holds that some x is fundamental iff nothing grounds x, akin to my claim that something is fundamental iff nothing determines it. This may be because 'grounding' and 'determination' are two names for the same relation (Audi 2012 suggests as much). Others are skeptical, however (e.g. Wilson 2014). Still others have been critical of under-standing physicalism in terms of grounding (e.g. Sider 2011, ch.8, though see Dasgupta 2014 for a response). Whether such criticisms also apply to determination is not entirely clear. Nothing here turns on adjudicating these issues, however. If it turns out that grounding and determination are the same relation then of course my determination talk can be substituted with grounding talk. If there are important reasons to distinguish them then grounding should be put aside for the purposes of my discussion.

Being fundamental is not sufficient for being *physically* fundamental, however. For Plato, Forms are fundamental but not physical. For Leibniz, monads are fundamental but not physical. For an idealist more generally, ideas (in a human or Divine mind) are fundamental but not physical. For Descartes, minds are fundamental but not physical. And so on. So what is it to be *physically* fundamental? One might think what is physically fundamental is whatever physics posits as fundamental. Although this is a popular conception, it is not without its problems. If being posited by physics as fundamental were sufficient for being physically fundamental then if physicists posited Cartesian minds (or Platonic Forms, or Leibnizian monads, etc.) as fundamental, then these would count as physical after all. But this is wrong: a world in which Cartesian minds (or Platonic Forms, or Leibnizian monads, etc.) are fundamental is a world in which physicalism is false. The explanation is historical (dis)continuity. Idealism, monadism, and dualism have always been opposed to physicalism (or materialism). So if it turned out that physics must posit a fundamental Cartesian mind to account for consciousness, say, this would be a concession that the historical opponents of physicalism were right after all (Wilson 2006). So just as there can be methodological constraints on what can count as physical—on the physics-based conception of physicalism something must be within the purview of physics to posit in order to count as physical (cf. Dowell 2006)—so too can there be historical constraints on what can count as physical: entities historically treated as incompatible with physicalism (or materialism) cannot count as physically fundamental (even if they exist). To be *physically* fundamental, then, something must at least be historically continuous with physicalism.[8]

What is it to be *nonfundamental* but physical? The short answer: to be determined by what is physically fundamental. Why determination in particular? Historical continuity again provides the answer. The physicalist's general claim is that the fundamental physical is that in virtue of

[8] Because I will argue that sortalism violates this condition, I will not discuss other conditions for being physically fundamental.

which everything else is as it is. Consider three traditional opponents of physicalism: emergentism, vitalism, and mind-body dualism. Common to these is the claim that some domain—chemical in the case of the emergentist, biological in the case of the vitalist, and mental in the case of the dualist—is not fully determined, explained, or fixed by the fundamental physical. So the debate between the physicalist and her opponent invariably turns on whether the entities in question are determined by the fundamental physical. It should then be no surprise that when it was finally shown by the mid-20th century that physical properties do determine chemical and biological properties, emergentism and vitalism were largely discarded.[9] That there remains a debate over whether mental properties are physical only confirms the claim here: because it has not yet been demonstrated to *everyone's* satisfaction just how—or whether—physical properties determine mental properties, there is still a debate over physicalism about the mind.[10] The dialectical pattern supports the conclusion: something nonfundamental is physical iff it is determined by the fundamental physical.

3. P2: Sortal identities and properties are not physically fundamental

Having explicated P1 in this section I defend P2: that sortal identities and properties are not physically fundamental. In the following section I defend P3: that sortal identities and properties are not determined by what is physically fundamental.

First a reminder of the terminology in play: I use 'sortal' for a kind of object, 'sortal identity' for an individual object's being an instance or instantiation of the unique or "primary"

[9] Papineau (2001, p. 20) makes a similar though weaker point. According to Papineau the success of the physical sciences through the 1950's sufficed to show only that no distinctly vital forces exist- not that determination was demonstrated. But the stronger claim is warranted: for in the absence of nonphysical or *sui generis* forces it is not clear what else could determine chemical and biological properties. And as what was being worked out was how to explain these properties in physical terms, this seems at (at least partially) tantamount to demonstrating determination. Thanks to Andrew Melnyk for discussion on this point.

[10] Of course, a subset of everyone—physicalists—believe this has been or will be shown shortly.

sortal that best expresses "what a thing most fundamentally is", as Baker puts it, and 'sortal property' for any property that is a consequence of a sortal identity, such as something's persistence conditions. One might still be unsure as to what exactly a sortal identity is, however; is it an object, a property, or something else?[11] As mentioned at the outset, and to be discussed in more detail shortly, the sortalist conception of objects has an Aristotelian (and Scholastic) heritage. That heritage recognizes something that by modern standards stands somewhat uneasily between object and property, however. Recall that a sortal is a kind of object such as *horse* or *cabbage* but not a kind of attribute, such as *color* or *shape*, and that this distinction harkens back to Aristotle's notion of "secondary substance" (see especially *Categories* 2b). For Aristotle, primary substances are individuals whereas secondary substances are kinds of individuals, with qualities or attributes being features of individuals. Because they are kinds, secondary substances are predicated of, or exemplified or instantiated by, individuals. For example, 'Socrates is a human' predicates a secondary substance of a primary substance, whereas 'Socrates is snub-nosed' predicates a quality of a primary substance. Contemporary metaphysicians—though E.J. Lowe (2006) is a notable exception—tend to assume that anything predicable of an individual is a property, however, even pleonastic "properties" such as *being a horse*.[12] But Aristotle wouldn't think of *being a horse* as a property simply because horses are objects (substances), not properties. Because sortalism is self-consciously Aristotelian (as e.g. Baker notes), a sortal identity should be conceived of along Aristotelian lines- i.e., as something's instantiating a secondary substance rather than its bearing a quality, attribute, or property. A further difference is also worth emphasizing. Because something's sortal identity is what something most fundamentally is, on this model, a sortal identity is also unlike the instantiation of a quality or feature with respect to

[11] Thanks to an anonymous referee for this journal for raising this concern.
[12] Lowe (2006) defends the substance-kind vs. attribute-kind distinction, which he too attributes to Aristotle's *Categories*, and which he claims is generally unrecognized by contemporary metaphysicians.

uniqueness; whereas something can bear many properties it can have only one sortal identity (for the same reason it can have only one set of persistence conditions).

With this in mind I turn now to premise P2 from the outset: that sortal identities and properties are not physically fundamental.

An electron is a leading candidate for being a fundamental physical object. Having negative charge is a leading candidate for being a fundamental physical property. Electrons, of course, have negative charge (presumably as an intrinsic and essential property). What is the relationship between being an electron and having negative charge? In particular is there a priority or determination relation between an electron's sortal identity and its property of having negative charge?

Recall Socrates' famous query to Euthyphro: "Is the pious loved by the gods because it is pious, or is it pious because it is loved by the gods?" (*Euthyphro* 10a). Socrates is in effect asking whether the gods' love determines and so explains what is pious, or whether what is pious determines and so explains what the gods love. Realizing that "Euthyphro-style" questions may reveal explanatory relations of priority and determination in other contexts, several more recent metaphysicians have applied the strategy. Armstrong (2004, p. 40) asks whether an object has a property in virtue of applying a predicate, or if the predicate is applied in virtue of the object having the property. (The latter being more plausible supports realism about universals over resemblance nominalism, Armstrong argues.)[13] Sider (2006) and Schaffer (2009) also employ variations of this Euthyphro-style strategy. I will follow them: to defend P2 I will use a Euthyphro-style question regarding sortal identity and what I'll call 'constitutive properties', i.e., plausibly intrinsic and essential properties such as an electron's having negative charge. The question is this: is something an electron because it has negative charge (among other constitutive

[13] Armstrong even goes so far as to claim that the Euthyphro dilemma "is in many ways the most useful dilemma in metaphysics," and that he relies on variations of it "at a number of points" (p. 40).

properties), or does something have negative charge (among other constitutive properties) because it is an electron? Like the original I will now argue this Euthyphro question yields a dilemma.

Suppose one takes the first option: that something is an electron because it has negative charge (among other properties; though henceforth this qualification will be dropped for brevity). From here the path to affirming P2 is straightforward. To say that something is an electron *because* it has negative charge is to say something is an electron *in virtue of* having negative charge, such that having negative charge *explains* something's sortal identity as an electron. Because fundamentality requires priority and metaphysical inexplicability, as discussed above, the first Euthyphro-option treats an electron's sortal identity as non-fundamental. From here getting to P2 is simply a matter of generalizing: assuming that electrons are not relevantly different than quarks or leptons, for example, or any other object, taking the first Euthyphro-option commits one to denying that sortal identities are fundamental. So taking the first Euthyphro-option concedes P2.

Might it be, however, that having a fundamental property is compatible with its obtaining in virtue of having, or being explicable in terms of, other properties? The distance relation may seem like a good candidate—Lewis for example calls spatiotemporal relations such as distance "fundamental relations" (Lewis 1994, p. 474)—even if distance relations obtain in virtue of relata occupying certain spacetime regions.[14] But this is off the mark. To be fundamental something must satisfy the criteria for being fundamental; simply calling something 'fundamental' is insufficient. And even if distance is fundamental *for a relation*—i.e., prior to any other relation—and so is a 'fundamental relation' in that sense, it may not be fundamental *simpliciter*. To be fundamental *simpliciter* something must satisfy the criteria for being fundamental *simpliciter*. And if

[14] Thanks to an anonymous referee for this suggestion.

indeed distance relations are derivative or obtain in virtue of something else—if some entities standing in a distance relation do so in virtue of their occupying certain spacetime regions—then by what criteria would distance be fundamental? If on the other hand one is working with a "relationalist" view of space(time) according to which distance relations do not obtain in virtue of anything then they would be fundamental but only because they satisfy the criteria in play here. So in order to show that something can be fundamental despite obtaining in virtue of something one must develop the requisite conception of fundamentality that can accommodate that. Absent such an account I will proceed with the criterial notion of fundamentality I have used thus far. And by that standard, as just argued, taking the first Euthyphro-option commits one to denying that sortal identities are fundamental. So taking the first Euthyphro-option concedes P2.[15]

So (to reject P2) suppose one takes the second option: that something has negative charge because it is an electron. This would make negative charge ontologically posterior to an electron's sortal identity, and would (at least) be consistent with the claim that nothing, in turn, determines an electron's sortal identity. The problem is that this option isn't available to the physicalist. Recall that being fundamental is not sufficient for being physically fundamental; some entities are precluded from being physically fundamental due to historical incompatibility with physicalism. (Cartesian minds were cited earlier as an example.) The same also goes for Scholastic substantial forms, along with their concomitant powers of formal causation. What I will now argue, however, is that by taking the second Euthyphro-option—i.e., by treating sortal identities as fundamental—one is in effect reintroducing substantial forms and formal causation at the

[15] One may think this first option obvious on the grounds that physicists simply define an electron as whatever has a certain mass, charge, and spin, say (thanks to an anonymous referee for this journal for the suggestion). Though I don't think matters are so simple—see my discussion in §4—this view is of course consistent with my overall defense of P2. Because my aim in this section is to explore the implications of each Euthyphro-option, however, I will temporarily put the issue aside.

fundamental level. So the physicalist cannot take the second Euthyphro-option any more than she can posit fundamental Cartesian minds.

The first step in the argument is to see why substantial forms and formal causation are inimical to physicalism. Some background is necessary here. A foundational plank in the Aristotelian-Scholastic view is that certain properties are entailed by the nature or essence of something. Because a person is (essentially) a rational animal, for example, being a person entails being rational. Also entailed by something's nature are necessary properties that are not strictly speaking part of its essence (traditionally called 'propria'). For example, people are necessarily (but not essentially) capable of humor because being capable of humor is entailed by being rational (or so the Scholastic claims). This entailment is also taken to be explanatory: being a person not only entails but explains being rational, which not only entails but explains the capacity for humor. This mode of (asymmetrical and transitive) explanation is not without metaphysical commitments, however. Being a person not only entails and explains having the capacity for humor, it also *causes* it.[16] Hence the frequent invocation in these contexts of causal terms such as 'flow' and 'emanation'; a standard Scholastic claim is that the capacity for humor flows or emanates from a person's rational nature, which thereby explains it. This entailment-cum-explanation-cum-causation is called *formal causation*, and its source is the *substantial form*, i.e. the general kind of substance to which an individual substance belongs (roughly what Aristotle calls 'secondary substance', as discussed earlier). Put together, the basic picture is that an individual substance possesses a substantial form which formally causes its necessary properties, thereby explaining them (cf. Banach 2007; Hill 2007; Oderberg 2007; Pasnau 2004; 2009).

[16] It may help to recall that Aristotle uses the same word—'aition'—for 'cause' and 'explanation'; these concepts were inextricably linked for Aristotle and his Scholastic follows. Of course such causation is not diachronic but synchronic, though according to the Scholastic it is causation all the same.

That this mode of explanation struck Early Modern physicalists (materialists) as sophistic and vacuous is well-known. It should also be obvious why this was so: there is no mechanism or physically tractable process by which formal causation occurs (cf. Pasnau 2009). Claiming that properties such as the capacity for humor flow or emanate from the substantial form of humanity does not explain the mechanics of *how* such properties actually come about. So for the Early Modern materialist "explaining" man's rationality or capacity for humor as some metaphysical consequence of the substantial form of *man* is no explanation at all. Instead the Early Modern materialist explains properties such as the capacity for humor in terms of more fundamental micro properties, such as the presumed geometrical properties of corpuscles or atoms. In general materialists argued there is some material process or mechanism by which the combination and arrangement of micro properties yields macro level characteristics and capacities.[17] Of course this model of explanation is retained by contemporary physicalists, who in order to explain the capacity for humor, say, simply substitute the neurological or biochemical properties of the brain (and perhaps its environment) for the primary qualities of corpuscles. But it remains the case that according to physicalists (nonfundamental) properties and capacities are ultimately explained not by substantial forms at the same (macroscopic) level as those capacities but rather by lower level or more fundamental physical properties.

Now imagine the Aristotelian-Scholastic's model applied to what we would otherwise think of as the physically fundamental level. Instead of the substantial form of *person* formally causing (constitutive) properties such as rationality and a capacity for humor, we instead have the claim that the substantial form of *electron* formally causes and so explains (constitutive) properties such as having negative charge. Or we have the claim that negative charge flows or emanates from the substantial form of an electron. But this just isn't something a physicalist can say. There

[17] Though it may well be that this was more a promissory note than something actually redeemed during the Early Modern period.

is no mechanism or physically tractable process by which an electron imbues itself with charge; to talk of 'flow' or 'emanation' is to posit what materialists traditionally derided as an occult (if not meaningless) process. Yet the Aristotelian claim here just is an affirmation of the second answer to the Euthyphro-style question posed above- namely, that something has negative charge *because* it is an electron. Succinctly put, because the Aristotelian answer is incompatible with physicalism and the second Euthyphro option just is the Aristotelian answer, the physicalist cannot take the second Euthyphro option.

I should pause here to address a certain objection. I just argued that the lack of a physical mechanism by which an electron would yield unit negative charge renders the Aristotelian view (of formal causation) incompatible with physicalism. But, one might point out, the issue regarding how electrons and negative charge are related is a generic issue regarding the fundamental metaphysics of property exemplification. And in addition to the Aristotelian view there are (at least) Armstrongian states of affairs, traditional bare particular theories, bundle theories, and various property nominalisms. But none of these involve any physics-familiar mechanisms, the objector points out; there are no such mechanisms that connect up bare particulars and universals into objects or states of affairs, or that connect up tropes into "bundles", or that explain certain nominalist's primitive resemblance facts. So if the Aristotelian view is incompatible with physicalism then any metaphysics of property exemplification is incompatible with physicalism. But as this is surely wrong, the objector concludes, my argument provides no particular reason to say the Aristotelian view is inconsistent with physicalism.[18]

But this objection misses the mark. The Aristotelian view (of substantial forms and formal causation) is not just another view of the metaphysics of property exemplification. It is perhaps better understood as a view of property *generation*. To see this return to the question 'why

[18] I thank an anonymous referee for pressing an objection along these lines.

is a human capable of humor?'. Note that 'because a human is a bundle of properties connected in a certain way' is not a candidate answer. Nor is 'because there is a metaphysical relation of exemplification which unites the person and her capacity for humor'. Instead, candidate answers to 'why is a human capable of humor?' include 'because the substantial form of *human* entails it' and 'because anything with xyz neurological properties (which humans typically have) can simultaneously process multiple interpretations of semantic input' (and so understand puns, say). In other words, the question 'why is a human capable of humor?' is asking for the source, cause, or genesis of that property in particular, not what holds a property and an object together (in general). And the same goes for 'why does an electron have unit negative charge?', *mutatis mutandis*. Put another way, theories of property exemplification take for granted that there is a certain object (such as a person) and a certain property (such as a capacity for humor) and then attempt to explain how they "hang together". But this is not an explanation for how something obtained a certain property in the first place, or why something has one particular property (e.g. negative charge) rather than some other (e.g. positive charge). The Aristotelian view, by contrast, is offering an explanation for how certain properties got there, i.e., how properties are generated (via formal causation or emanation), and why certain kinds of things have certain properties rather than others (because it's in the nature of the thing to be one way rather than another). But these answers are compatible with any number of views of property exemplification. In fact, one can even take for granted some particular theory of exemplification—properties are tied to substances by a special kind of metaphysical glue, say—and still wonder if it is in virtue of a sortal identity (such as an electron's) that something has a certain property (such as unit negative charge), as opposed to these being only contingently connected, or connected via a priority relation running in the other direction. So contra the objection my above argument does not in

fact overgeneralize; it specifically targets the Aristotelian conception and shows why it in particular is incompatible with physicalism.

Even if the Aristotelian-Scholastic conception is incompatible with physicalism, though, one might suppose one could still take the second Euthyphro option—that something has negative charge because it's an electron—but without endorsing the Aristotelian-Scholastic view that is incompatible with physicalism. One might even think this is just what contemporary sortalism allows one to do; perhaps a contemporary sortalist might defend the second Euthyphro option (the fundamentality of sortal identity) while maintaining compatibility with physicalism. But this move fails- the reason being that there is no substantive difference between historical Scholasticism and contemporary sortalism; the views are effectively equivalent, differing only in terminology. Or so I will now argue.

Consider first Grandy's (2016) summation (in the *Stanford Encyclopedia of Philosophy*) of the three "main ideas" regarding sortals. The first is that a sortal is something's essence, such that a sortal provides the fundamental or metaphysically best answer to 'what is it?' when asked of an individual. The second is that a sortal allows one to count something as one unified thing at a given time (synchronically). The third is that a sortal establishes unity and identity over time (diachronically). Consequently a sortal establishes the distinction between changes that are the creation or destruction of some substance—often called 'substantial change'—and changes something can undergo and still survive- often called 'accidental change' or 'mere alteration'.

Yet this is exactly what the Aristotelian-Scholastic says about substantial forms. To reiterate, according to the Scholastic something's substantial form is 1) what something is most fundamental or essentially (cf. Pasnau 2011 p. 551), 2) the basis of synchronic unity and identity (ibid., p. 555), and 3) the basis of diachronic unity and identity, such that the absence or presence of a substantial form is what distinguishes substantial from accidental change or "mere alteration"

(ibid., pp. 550, 557, 663, *passim*). So what should one conclude from this? One option is that sortals and substantial forms have exactly the same job description and do exactly the same work but they are distinct entities, or, perhaps, competing conceptions of how this work gets done. The second option is that contemporary sortalism just is the Aristotelian-Scholastic view but expressed with modern terminology. I find the latter option overwhelmingly more plausible, for several reasons. First, note that each view fills in the schema in exactly the same way: for natural individuals (rather than artifacts) the paradigm examples or candidates for both substantial forms and sortals are invariably familiar biological kinds (e.g., species or genera such as *human* or *horse*). Second, note that the same priority and determination claims are made by the contemporary sortalist and the Aristotelian-Scholastic; each claims that something's essence—whether substantial form or sortal—*determines* something's identity and persistence conditions, in particular those befitting something's biological kind-membership. For example recall the passage of Baker's (2002, p. 372), quoted at the outset, who affirms

> an Aristotelian assumption. For any x, we can ask: What most fundamentally is x? The answer will be what I will call x's 'primary kind'. Everything that exists is of exactly one primary kind- e.g. a horse or a passport or a cabbage. A thing's primary kind determines its persistence conditions. And since its primary kind property determines what a thing most fundamentally is, a thing has its primary kind property essentially: it could not exist without having its primary kind property.

So not only does Baker invoke a determination relation between kind (sortal) identity and persistence conditions, but further note that one can seamlessly substitute 'substantial form' for 'primary kind' in this same passage with no apparent loss or change of content. Hence, consider

> an Aristotelian assumption. For any x, we can ask: What most fundamentally is x? The answer will be what I will call x's [substantial form]. Everything that exists is of exactly one [substantial form]- e.g. a horse or a passport or a cabbage. A thing's [substantial form] determines its persistence conditions. And since its [substantial form] property determines what a thing most fundamentally is, a thing has its [substantial form] property essentially: it could not exist without having its [substantial form] property.

Given this seamless substitution I cannot see any reason to think Baker's "primary kinds" are relevantly different from the Scholastic's substantial forms, nor that the sense by which a thing's primary kind "determines its persistence conditions" is anything other than what used to be called 'formal causation', as discussed above. Further evidence is that even Pasnau uses the same word to describe the historical Scholastic view in his monumental work on medieval metaphysics; according to Pasnau substantial forms or essences "define what a thing is, and so *determine* its identity conditions" (2011, p. 637, my emphasis). If Baker's use of 'determines' is substantively different than Pasnau's, and/or the contemporary sortalist uses 'determines' or 'is determined by' to mean something substantively different than what the Scholastic means by 'formally causes' or 'emanates from', then either Pasnau is wrong to use the word 'determines' in this context or else he's failing to make a necessary disambiguation (between 'determines' in the Scholastic sense and 'determines' in the contemporary sense). But I see no reason to think there is a substantive difference, and I see no reason to think Pasnau is mistaken or imprecise. I conclude from this that there is no substantive difference between the Scholastic view and contemporary sortalism; to accept the sortalist picture is to accept the Scholastic view but with modern terminology.[19]

Still, one might be tempted to think contemporary sortalists are not fully committed to "full-blown" Aristotelian-Scholasticism regarding substantial forms and formal causes.[20] But this objection presupposes what is at issue: namely, that there is a distinction between the contemporary and historical views, and, moreover, that the views differ in strength such that it

[19] Perhaps this shouldn't be surprising. After all, even Grandy notes that "many philosophers (e.g. Wallace 1965) have claimed that the notion of a sortal is the same notion as developed by Aristotle under the label 'secondary substance"'- a claim which Grandy does not dispute. Also telling is that the term 'sortal' was coined by Locke in order to discuss Scholastic notions of kind-essence (*Essay Concerning Human Understanding*, Bk.III, Ch.III, 15). Moreover, it's not a coincidence that Baker calls her own assumptions "Aristotelian", nor that the Scholastics were Aristotelians in the first place: something's substantial identity being fundamental and yielding sort-specific properties such as persistence conditions just is a basic plank of the Aristotelian worldview that Scholastics and contemporary sortalists inherited.

[20] I thank two anonymous referees for this journal for pressing me on this point.

creates an argumentative burden. That is, the objection presupposes a distinction between a weaker contemporary view (call it 'P') and a stronger ("full-blown") historical view (call it 'Q'), such that there is a burden to show that accepting P incurs a commitment to a further view Q which proponents of P might otherwise disavow. But this is incorrect. My claim is not that Q is some further (and stronger) view such that proponents of P might disavow Q whilst still advocating P. Instead, what I have argued is that P and Q are one and the same view, such that any apparent difference is merely notational or terminological rather than substantive or philosophical. In light of this argument I believe the onus is on she who would deny the equivalence to find a substantive rather than nominal difference.

Consider one last argument in the form of a thought-experiment. Imagine a contemporary sortalist gains access to a time-machine and travels back 500 years to discuss metaphysics with a Scholastic. Further suppose that after hearing an explanation of contemporary sortalism the Scholastic replies by saying "you seem to have captured my view precisely; I'm so glad to hear Scholasticism remains alive and well in the 21st century." Naturally, the crucial question is whether the Scholastic's impression is wrong. If it is then the sortalist should be able to explain or articulate the difference between her view and the Scholastic's. Because I can think of nothing plausible the sortalist might say here—the only candidates that come to mind are nonstarters[21,22]—I can only conclude that sortalism and Scholasticism are effectively equivalent.

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[21] For example, suppose the sortalist claims that unlike the Scholastic the sortalist's explanation of sortal properties by a sortal identity is not meant *metaphysically*, and in so doing she denies *any* metaphysical relation whereby a sortal identity yields a sortal property- whether formal causation or metaphysical determination or anything else. Instead, the distancing suggesting goes, sortal identities explain sortal properties in some other way (say, conceptually or logically). But if so sortalism would no longer answer my Euthyphro-style question, which queries *metaphysical* explanation and seeks to reveal *ontological*—rather than logical or conceptual—priority. (Moreover, sortalism has hitherto been understood as a metaphysical theory of sortals, not a theory about how we employ sortal concepts or vocabulary.) Consequently the sortalist must have real *metaphysical* explanation and so real *metaphysical* determination in mind. (Surely this is how Baker's passage is to read in any case.) But then if indeed the sortalist's metaphysically explanatory determination relation is different than what the Scholastic calls 'formal causation', the sortalist should be

So where does this leave us? Earlier I argued the second answer to the Euthyphro question—that something has negative charge because it is an electron, for example— is unavailable to the physicalist because it is the Aristotelian answer. I have now argued that contemporary sortalism provides the same answer and is in effect equivalent to the Aristotelian theory. It is therefore unavailable to the physicalist as well. So the physicalist must reject P2; for the physicalist, sortal identities and properties are not fundamental.

4. P3: Sortal identities and properties are not determined by the fundamental physical

In the previous section I agued that sortal identities and properties are not physically fundamental. So to count as physical they must be determined by what is physically fundamental (per P1). Yet one might think this straightforwardly follows: for example, it may seem obvious that possessing the quantities of charge, mass, and spin characteristic of an electron determines that something is an electron. And if so then P3 is false.

This does not follow at all, however, let alone straightforwardly. Rather than determining sortal identities and properties, fundamental nonsortal physical properties *underdetermine* sortal identities and properties. A familiar example illustrates the problem. Consider a lump of clay (call

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able to articulate the difference in conversation. Because I can think of nothing plausible the sortalist might say here I can only conclude that the views are equivalent.

[22] Keeping in mind the metaphysics constraint discussed in the previous note, there is one candidate which may seem plausible: viz., that the historical view advocates a teleology the contemporary view lacks. But this is no defeater either, for two reasons. First, if the contemporary and historical views are the same except for a *further* posit of teleology, then teleology is not actually a logical commitment of the shared core and so could in principle be excised by a proponent of the historical view as well. Second, note that I made no appeal to teleology in order to show that substantial forms are incompatible with physicalism; it is simply the fundamentality of sortal identity and formal causation, I claimed, that renders the Scholastic view incompatible with physicalism. So even if there are *further* or additional Scholastic views that go beyond what I've discussed that the contemporary sortalist might disavow, this is irrelevant to my argument here: as long as the contemporary and historical views overlap or are substantively identical with respect to the tenets discussed above, this is sufficient to show that the contemporary view is incompatible with physicalism for the same reason the historical view is.

it 'Clay'). It has certain nonsortal physical properties, including a particular mass, density, chemical composition, and shape (as well as relational nonsortal properties, including historical features). It is tempting to think that it is in virtue of having these properties that Clay has the sortal identity it has (viz., its being a lump of clay), as well as the sortal properties it has (such as being able to survive significant changes in shape). Matters are not so simple, however. Something might well have those same nonsortal properties yet be unable to survive significant changes in shape- namely, the statue (call it 'Statue') made from that lump of clay. Although Statue and Clay share their nonsortal features, their sortal identities and properties differ. It follows that the nonsortal properties in question do not determine—but rather underdetermine—the sortal identities and properties of Statue and Clay.

Naturally the problem threatens to generalize: if nonsortal properties in general underdetermine sortal properties then P3 is true (as I maintain). So to reject P3 the defender of physical sortals must solve what has come to be known as "the grounding problem", viz., the problem of what grounds (or determines) the different sortal identities and properties of objects such as Statue and Clay. How might the prospective physicalist-cum-sortalist achieve this? Discussions of the grounding problem do not generally concern physicalism *per se*, however. So what I will do is consider a selection of proposed solutions to see if they are of any use to the sortalist who wishes to remain a physicalist. I will argue, however, that they are not: extant solutions are either physicalistically unacceptable or else physicalistically acceptable solutions jettison the sortalist metaphysic. I conclude that sortal identities and properties are underdetermined by the fundamental physical properties (i.e., that P3 is true).

Purported solutions to the grounding problem divide into two (exclusive and exhaustive) categories: those that allow for the coincidence of numerically distinct objects (such as Statue and Clay), and those that do not. I begin with the coincidence-friendly solutions, which often employ

a similar strategy: they deny that Statue and Clay share all and only the same parts, and instead posit "extra" entities as non-shared parts (entities which are not thought to be parts of Statue and Clay *prima facie*). For example, Paul (2006) argues that objects are composed not only by (smaller) objects but by properties as well.[23] Although Statue and Clay share their object-parts (and so materially overlap), Paul argues, they have different (sortal) property-parts (and so do not qualitatively overlap). Fine (2008) also argues that Statue and Clay have different constituents (cf. Divers 2008): although they share the same matter they possess different *forms* (where each is a hylemorphic composite- i.e., a composite of form and matter).

Even if an account along these lines is right, however, it may not be enough: for these to count as *physicalist* solutions to the grounding problem the posited entities must also satisfy the criteria for being physical- namely, being physically fundamental or determined by the physically fundamental. Yet there is little reason to think Paul's or Fine's entities satisfy the criteria. Fine explicitly claims the forms he posits are not scientifically discernible and are only accessible *a priori* (2008, p. 104). Whether such nonempirical entities can be squared with the physicality criterion defended above remains to be seen. Paul, on the other hand, does attempt an explanation: she suggests "spatiotemporal" objects "generate" modal or sortal properties by "standing in relations to external objects" such as other-worldly counterparts, or the sort (i.e., the abstract kind) of which they are instances (2006, p. 651). But this is problematic. Regarding the former, I will argue in the next section that even if physical properties determine counterpart-theoretic sortal and modal properties (as trans-world similarity relations), this is a kind of "sortal ersatzism"; genuine sortal identities and properties (as conceived by the sortalist) are left underdetermined by the basic physical properties. For now, though, I turn to Paul's latter option- that sortal properties are generated by objects standing in relations to (abstract) sorts.

[23] Paul considers this a kind of bundle theory, but with the familiar mereological notion of fusion replacing the more traditional (and perhaps more obscure) notions of compresence or bundling.

There are two reasons this won't render sortal identities and properties physical. First, absent a physicalistically acceptable account of the existence and nature of these (abstract) sorts, Paul's suggestion is no advance; the problem is simply recapitulated. One might object that this is an unfair demand, however, on the grounds that this is just the generic requirement of explaining *abstracta*, which presents no special burden for the physicalist. But this is off the mark. Presumably the instantiation of all of Statue and Clay's nonsortal and nonmodal properties are determined by the fundamental physical- so nonsortal and nonmodal properties being abstract (in general) does not preclude their instantiations from standing in a determination relation with the fundamental physical. So the question is not the general relation between abstract properties and the fundamental physical but the peculiar status of sortal and modal property instantiations vis-à-vis the fundamental physical. So the defender of physical sortals must show that sortal and modal property instantiations are determined by the fundamental physical, just as nonsortal and nonmodal property instantiations are. Absent such a demonstration the extra entities posited by Paul and Fine cannot be reckoned physical.

Paul's and Fine's are not the only coincidence-friendly accounts, of course, and it may be that others are more physicalist-friendly. As noted earlier, however, solutions to the grounding problem are not typically proposed with physicalist constraints in mind. So there is little reason to expect a different result. Take Bennett's influential (2004) paper for example. Bennett canvasses a variety of strategies the friend of coincidence might adopt. She concludes the best option is to take as primitive that all the possible ways of distributing essential and accidental properties over spacetime regions are in fact realized (such that "bazillions" of things coincide rather than only two; p. 356). No physicalist can accept this, however. For on this proposal the distribution of

what Bennett calls "sortalish" properties obtains independently of the distribution of fundamental physical properties, not in virtue of them (as the physicalist requires).[24]

As indicated I can only canvass a selection of responses, though I grant that to prove my point I'd have to show that each and every coincidence-friendly solution is physicalistically unacceptable. In lieu of that I will settle for having shifted the burden of proof: given the physicalistic unacceptability of the prominent solutions discussed here, the onus is on she who would claim the physicalist can accept a coincidence-friendly solution to the grounding problem.

I turn now to coincidence-unfriendly solutions. Precisely because the coincidence of Statue and Clay seems mysterious (from a physical point of view), many have denied their being numerically distinct.[25] But this does not avoid the problem: as Bennett (2004, p. 340) and Fine (2008, p. 109) have shown, the grounding problem does not rely on the coincidence of numerically distinct objects. Even if the individuals Statue and Clay are identical a statue in one location and a lump elsewhere may be otherwise physically indiscernible whilst (apparently) differing sortally. So (at least) two questions remain. First, what determines that statues and pieces of clay have their respective sortal identities and properties? Second, what determines whether it is statue-ish or clay-ish sortal properties that are instantiated in the region where Statue and Clay appear to be? Because identifying Statue with Clay does not *eo ipso* answer these questions the sortalist who wishes to be a physicalist must say more to solve the grounding problem. Though one might suppose anti-coincidence arguments can be used for this purpose, I will now argue this strategy does not succeed either.

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[24] Even if the distribution of sortalish properties would *supervene* on the fundamental physical properties in this scenario, the latter would not *determine* the former. And as Bennett herself is at pains to point out, supervenience is insufficient for determination (2004, pp. 342–344, *passim*).

[25] An early instance is Gibbard (1975), whose famous case of Lumpl and Goliath spawned much of the material coincidence literature. In particular Gibbard argued for the (contingent) identity of the statue and the clay on the grounds that the denial of their identity has statues taking on a "ghostly air" (p. 192).

Broadly speaking, if it's not the case that two (or more) objects exist where Statue and Clay appear to be, then there are either one or zero. Mereological nihilists such as Rosen and Dorr (2002), according to whom there are no composite objects at all, argue for the latter option. This is a nonstarter here, however: if there are no composite objects with sortal identities and properties then such objects do not exist if physicalism is true.[26] So consider instead Lewis' (1986, pp. 253–4) famous identity thesis.[27] Obviously, any account which identifies Statue and Clay must explain (away) how one object can have two seemingly incompatible sortal profiles. Lewis' account appeals to his general theory of *de re* modal properties, which he analyzes as (nonmodal) similarity relations between counterparts. To illustrate, suppose I am able to survive the loss of a particular hair. What this amounts to, on Lewis' view, is that I have a counterpart who did lose that hair (or that hair's counterpart) and who still exists. Similarly, to be able to survive a squashing is to have squashed counterparts, whereas to be unable to survive a squashing is to have no squashed counterparts; thus, Clay has squashed counterparts but Statue does not. But how can this be, if Statue and Clay are identical? For Lewis the question is wrong-headed, as the counterpart relation is highly variable and context-dependent. Here, using 'Statue' evokes a context in which squashed objects do not count as counterparts, whereas using 'Clay' evokes a context in which they do. But this does not imply the non-identity of Statue and Clay any more

[26] Moreover, what the eliminativist ontology has instead of ordinary objects—namely, mereological simples in various arrangements—lack precisely those features associated with a sortal identity. For instance, rather than being *one* unified tiger, say, simples arranged tigerwise are merely *many* loosely assembled objects. These simples would also lack the persistence conditions associated with tigers. And so on for all Fwise arrangements, for any putative sortal F.

[27] Strictly speaking Lewis only advocates identity for what might be called a 'permanent overlap' case, i.e., a case where x and y are created and destroyed simultaneously. For a 'temporary overlap' case—where one of x or y precedes or succeeds the other— Lewis thinks x and y are not identical, but are rather partially overlapping four-dimensional space-time "worms". Even so, Lewis does not advocate material coincidence because in the temporary case there is "partial identity", i.e., identity in the restricted region where otherwise distinct objects overlap; just as two intersecting roads completely overlap at their intersection (and so are identical there) but differ in virtue of nonshared parts elsewhere (the rest of each road). Accordingly, my discussion of Lewis' "identity thesis" should be restricted to permanent overlap cases. That being said, I address the possible objection that this assumption isn't innocent in footnote 32. I thank an anonymous referee for this journal for discussion on this point.

than my having some bald and some non-bald counterparts implies I am distinct from myself. So for Lewis, rather than there being two coinciding objects with incompatible persistence conditions, there is one object with two sortal-specific names, each of which evoke one or another set of sortal-specific counterparts.

I argued above that even if a solution to the grounding problem is right, it may not save the physicality of sortal identities and properties. The same applies here: even if Lewis' counterpart-theoretic semantics of sortal and modal predication is correct, whether this renders physicalism and sortalism compatible is a further question. I will now argue it does not- for Lewis' view is effectively a rejection of sortalism. To see this suppose that instead of referring to Statue/Clay by a sortally-specific name one refers to it via a sortally-neutral name (or a name which is neutral between statues and lumps of clay); let 'Object' be such a name.[28] Further suppose at time t_1 Object is not squashed but at t_2 it is. Does Object still exist at t_3? If Object were a statue it would not exist but if Object were a lump of clay it would. So what is Object's sortal identity: is Object a statue, a lump, or something else? There appears to be no answer on Lewis' account. After all, and as we just saw, Statue/Clay does not *intrinsically* have the persistence conditions of either statues or lumps of clay (so neither does Object intrinsically have the persistence conditions of objects- whatever those might be). Instead, for Lewis, sortal identities are acquired only when sortally loaded names are applied; "in themselves" objects are sortally neutral.[29] Therefore, and as Sider (2001, p. 207) concedes on behalf of the Lewisian, facts about

[28] Some reject the possibility of sortally-neutral reference (e.g. Thomasson 2007). Requiring sortally-specific reference does not sit well with Lewis' mereological universalism, however. For Lewis, "arbitrary" mereological fusions (such as the sum of the Eiffel Tower and this sentence-token) do not fall under any familiar sortals- unless highly generic terms such as 'object' or 'thing' count. So if these are not sortal terms yet one can determinately refer to any given mereological sum reference need not be sortal-specific (and 'Object' may refer determinately absent a sortal). But even if 'object' and 'thing' do count as sortals my point goes through: because statues and lumps are both things (or objects), referring to this thing via the thing-name 'Object', without invoking either statues or lumps of clay, is legitimate.

[29] See Sidelle (2010) for criticism of this sortally-neutral view of objects.

which changes an object can survive are largely conventional- the reason being that the ability to survive a given change depends on how the object is picked out, rather than how the object is, intrinsically.[30,31] Whatever this view's merits this is clearly not what the sortalist is looking for: sortalism requires there be inherent or built-in sortal identities and properties, such that an object's existence and identity is a *local* (rather than trans-world) affair. So the situation is this. If Lewis is right then sortalism is false, in which case Lewis would not help sortalism satisfy the criteria for physicality. But if Lewis is wrong—if there are facts about sortal identities Lewis doesn't recognize—then again Lewis' account is no help to the sortalist looking to save physicality.[32] In neither case does Lewis' account render sortalism compatible with physicalism.

Thus far my discussion of the grounding problem has concerned macro or nonfundamental entities. To conclude my defense of P3 it remains to show that these issues recapitulate at the micro level. Just as Statue and Clay are distinct insofar as their nonsortal

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[30] This scenario generalizes across worlds. In presenting Lewis' view I took it for granted that Statue/Clay/Object has some counterparts that exist after a squashing and others that do not. But suppose we pick out a counterpart via a sortally neutral name; call one Object_{w1}. Does Object_{w1} survive the squashing in *its* world? Well, it does if it's a lump but not if it's a statue. But Object_{w1} is no more a statue to the exclusion of a lump of clay (or vice versa) than Object is, in this world. So the scenario is reiterated at each world: at each world none of Object's counterparts has an intrinsic sortal identity.

[31] It's also worth noting that this is not simply a product of vagueness (or "semantic indecision"); even if 'Object' is initially ambiguous between any number of referent-candidates, for any given precisification of 'Object' it remains an open question whether *it* is a statue, lump, or something else.

[32] I noted earlier that my discussion of Lewis pertains to his account of permanent rather than temporary overlap cases (footnote 27). But one might think this assumption is not innocent. An anonymous referee for this journal points out regarding my "Object" argument that if Statue and Clay are squashed at t_2 then Lewis can say Statue ceases to exist and Clay survives without even invoking his sortal-relative counterpart theory. Even if true this does not affect my argument, however. To see this note one can distinguish temporary from permanent overlap cases only if one comes equipped with knowledge of persistence conditions, such that one can judge that x continued while y ended. But then what are we to say about Object? Consider two variations. In the first Statue is destroyed but Clay remains, such that this is a temporary overlap case as far as Statue and Clay are concerned. But what about Object? Does Object continue to overlap with Clay or not? Because 'Object' is sortally neutral the answer is indeterminate, and as a result it is indeterminate whether this is a permanent or temporary overlap case. So consider the second variation: both Statue and Clay are destroyed at t_2, rendering it a permanent overlap case as far as Statue and Clay are concerned. But is Object also destroyed? Because 'Object' is sortally neutral the answer again is indeterminate, and so again it is indeterminate whether this is a permanent or temporary overlap case. So regardless of the permanent/temporary distinction the sortal identity of Object is indeterminate, and my argument goes through.

properties may be variably possessed accidentally or essentially, for example, so too might the nonsortal properties of electrons be variably possessed accidentally or essentially. Call 'Electron' the object that has certain quantities of mass, charge, and spin essentially, and call 'Electron*' the object that has those same nonsortal properties accidentally. Here too the instantiation of the nonsortal properties does not determine—but rather underdetermines—whether these properties are possessed accidentally or essentially. So the grounding problem reemerges at the micro level. None of Fine's, Paul's, or Bennett's solutions to the grounding problem is available to the sortalist-cum-physicalist here either. Just as Statue's and Clay's different forms are only accessible *a priori* and not scientifically discernible, according to Fine, the same goes for the different forms possessed by Electron and Electron*; these nonempirical micro-level forms are no more physical than their macro level counterparts. Regarding Paul: although electrons have no smaller objects as parts (i.e. electrons are mereologically simple), electrons are not simple with respect to property-parts. As such, Paul's theory of property-mereology would have electrons and electrons* composed of distinct (sortal property) parts. But then the problem here, as above, is that these are peculiar vis-à-vis the nonfundamental nonsortal property instantiations that *are* determined by the fundamental physical. And the problem with Bennett's view reemerges as well: if it is a primitive fact that negative charge is possessed both essentially and accidentally (by different things) then nothing determines this fact, from which it follows *a fortiori* that the fundamental physical does not determine it. Nor is Lewis' coincidence-unfriendly view helpful, according to which 'Electron' and 'Electron*' would be two names for the same object. Upon a change in properties (an increase in mass, say), Lewis would deny that Electron* persists but Electron does not; rather, the names evoke contexts in which different sets of other-worldly individuals serve as counterparts. But as above we then introduce a third and sortally-neutral name for this object- call it 'Micro-Object'. And also as argued above, the nonsortal fundamental

properties leave open—and thereby underdetermine—the sortal facts regarding Micro-Object's existence, sortal identity, and properties. So to conclude: sortal identities are not physically fundamental, nor are they determined by what is physically fundamental. Sortalism is therefore incompatible with physicalism.

This raises a final objection. If the sortal identity and properties of an electron are not physical, this seems to imply—absurdly—that electrons are not physical. But this is a misunderstanding. To see this consider a brief sketch of a view about sortal terms. Under what conditions can sortal terms be applied? One might suppose certain combinations of nonsortal properties are sufficient. If a certain mass, charge, and spin are co-instantiated in a region, for instance, one might think this suffices for truly asserting (of that region) 'there is an electron here'. Via some disquotational schema one might think it follows that there is an electron in the region. But if so then not only do nonsortal physical properties determine the application of sortal terms (such as 'electron'), but the presence of certain physical properties in a region determines that there is something with a sortal identity (such as an electron) in the region. Contrary to my thesis, therefore, physical properties do determine sortal identities after all. But this is a mistake. First, because the conditions for applying 'electron*' are (synchronically) the same as those for 'electron', whether a sortal-identity term *uniquely* applies is in fact underdetermined by the nonsortal physical properties instantiated in the region. Second, and more importantly, even were one to grant the objector her view of sortal terms, it is important to see that this maneuver transfers the work ostensibly done by the world to language. Consider (synchronic) unity first. Mass, charge, and spin are three properties, not one. Yet for the sortalist an electron is one unified object- a single countable instance of a kind.[33] This raises the question

[33] Moreover, sortals are often distinguished from non-sortals by their ability to confer unity and countability; *tiger* is a sortal but *red* is not because one can count individual tigers but not red things (Grandy 2016; Wiggins 2001).

of whether these three properties are unified "in themselves", or whether they are only treated as one unified entity insofar as a single count-noun is applied by a sentient being (to multiple properties). If the former then the sortalist will think some additional element beyond the three nonsortal properties is necessary for their unity (perhaps a distinctive sortal identity or property which acts as a unifier). But in that case the nonsortal properties themselves are insufficient-*contra* the meta-linguistic view sketched above. So suppose instead that the unity is only apparent (due to the application of a count-noun). But then nonsortal properties do not determine that a certain group of properties are unified as a single countable instance of a kind (i.e. a sortal identity), for there really is no such thing to be determined.

To consider diachronic unity (i.e., persistence over time), return to the statue and clay example (though the same applies, *mutatis mutandis*, to the differing sortal profiles sharing the nonsortal properties of electrons described above). Here the analogous meta-linguistic view works like this. If a certain statue-shaped lump of clay is present both 'clay' and 'statue' are applicable. If the shape changes in a certain radical way 'statue' is no longer applicable though 'clay' is. Thus the (nonsortal) conditions that make sortal terms applicable are entirely determined by the fundamental physical properties. Which is just to say, as above, that nonsortal properties determine persistence conditions, i.e., sortal properties. Although I have no objection to this use of sortal terms *per se* my question here is the same as above: what is the metaphysical scenario underlying the meta-linguistic one? It appears to be this: what exists are various nonsortal property instantiations, evolving or changing over time. In themselves no one change counts as the persistence or cessation of a given entity, however. What brings persistence into the picture are rules for the (re)application of sortal terms; what counts as the persistence of a statue (or a lump of clay) is a product of the rules we accept for applying the term 'statue' (or 'clay'). Although this may ultimately be true, saying so concedes that in physical reality (independently of

our linguistic frameworks or rules) there are no facts about whether an entity really persists or not. There is just a (Heraclitean) flux which our language falsely treats as containing persisting entities. But this is perfectly consistent with my thesis: for it might well be that in a purely physical world lacking sortal identities and properties, language-users might still apply sortal terms to the passing show in the suggested manner. That would not imply that genuine sortal identities or properties are physical, however. It would instead be to concede that a purely physical world contains no such things in it.[34,35]

5. Conclusion

I have argued that sortal identities and properties are not physical. From this point there are at least three options. One may reject the sortalist metaphysic on the grounds that physicalism is true, or reject physicalism on the grounds that sortalism is true. Another option would be to reject the orthodox version of physicalism I've presented in favor of one that might accommodate sortalism (i.e., one might reject P1).[36] Doing so would require conceding, however, that at least as traditionally understood physicalism is incompatible with sortalism.[37]

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[34] Because I take this meta-linguistic objection to involve a conceptualist or anti-realist view of sortal properties, I have not discussed conceptualism separately as a physicalist (dis)solution to the grounding problem. For that view, though, see Sidelle (1989; 1998; 2010) and Einheuser (2010).

[35] Worth noting is that Scholastics cited this consequence of a sortal-free world in defense of substantial forms against materialist atomism; Scholastics claimed that if there were no substantial forms, but only atoms moving about in the void, then there would be no distinction between substantial change and mere alteration, i.e., no substances would ever come to be or cease being, but, rather, there would only be the mere alterations of atoms taking on various accidental shapes or arrangements. Thinking this situation absurd Scholastics rejected atomism in favor of substantial forms (Pasnau 2011, pp. 553, 677).

[36] For instance, on Melnyk's (2003) "realization physicalism" a sortal counts as physical if it is realized by physical entities, rather than being determined by them. So insofar as the (physical) lump realizes Statue's and Clay's sortal properties, sortals count as physical. There may remain the worry, though (as with Paul and Fine), that this presupposes that sortal properties exist rather than accounting for them given only a physical base (which is surely a task of the physicalist on any conception). Alternately, one might define 'physical' in terms of paradigm physical objects (Stoljar 2001; Strawson 2006). Such views either beg the question against the idealist, however—surely the idealist's paradigms of mental objects look awfully similar to the physicalist's paradigms of physical objects—or else this strategy fails to distinguish physicalism from idealism at all (though perhaps this is something that Strawson, who advocates

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panpsychism, might actually embrace). Another option is the *via negativa* strategy- defining the physical as the non-mental; see e.g. Montero and Papineau (2005). Whether the physical as the non-*sortal* will avoid the present difficulties, though, is not clear.

[37] One might wonder, as an anonymous referee for this journal did, whether on my account functional kinds or properties (such as being a clock) are inimical to physicalism. Space forbids in-depth discussion, but the brief answer is that they are not (at least, not necessarily). The reason is that something can posses the (physical) qualities or attributes necessary for fulfilling a function (e.g. being a clock) without that functional kind being what something most fundamentally is (i.e., its sortal identity), or without that functional kind governing or determining its persistence conditions (something might still exist after ceasing to function as a clock, for example). Moreover, and as a result, functional kinds so-construed would not yield coincidence-problems, and as a result would not be subject to the arguments given above. That being said, functional kinds, like everything else, are subject to the generic physicalist constraint of having to be physically fundamental or determined by what is fundamental in order to be counted physical (cf. my comments in the previous note regarding Melnyk's 2003 "realization physicalism").

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