# The Location of Properties

NIKK EFFINGHAM

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ABSTRACT: This paper argues that, assuming properties exist and must be located in spacetime, the prevailing view that they are exactly located where their instances are is false. Instead a property is singularly located at just one region, namely the union of its instance's locations. This bears not just on issues in the metaphysics of properties, but also on the debate over whether multi-location is conceivable and/or possible (and, by proxy, any theory that relies on that e.g. certain formulations of endurantism/perdurantism).

This paper assumes throughout that properties exist and:

> **Properties Are Located:** If *x* is a property, there is some region *r*, and *x* stands in some location relation to *r*.[1]

The prevailing view is that, given **Properties Are Located**, properties are multiply located where their instances are. This paper argues that this is false and that a property is instead a singularly located entity spread across a scattered region composed of all of the locations of each of its instances. §1 introduces the lay of the land and the main line of argument: that we should default to my position, arguments to the contrary notwithstanding. Proposed arguments to the contrary are: that properties are multiply located because instantiation should be analysed in terms of location; Plato's Sailcloth Dilemma; and that properties are multiply located because only multiply located properties can be constituents of singularly located objects. §§2-3 explain why those arguments fail. With those arguments dispatched, §4 discusses what we can draw from properties not being multiply located, namely how it affects the debate over the conceivability of multi-location and how it relates to the metaphysics of persistence.

## 1. Located Properties

### 1.1 Chorology and properties

Call relations concerning location 'chorological relations'. Construct a simple chorological system taking the relation '__ is exactly located at spatial region __ (at time __)' as a primitive (temporal relativisations will be kept implicit, and we may say 'exactly occupies' instead of 'is exactly located at'). The following examples ostensively define it:

> The cube is exactly located at just one cube-shaped region.
>
> The Kuiper Belt exactly occupies a scattered region composed of lots of non-overlapping asteroid shaped regions.
>
> A sphere of radius *n* is exactly located at some region with a volume equal to $^4/_3\,\pi n^3$.

Define two more chorological terms:

[1] This, notably, excludes Armstrong's intermittently supported position that properties are 'in' spacetime only in so far as they're constituents of states of affairs [1989*a*: 105*n*1; 1989*b*: 98-99]

$x$ is partially located at $r =_{df}$ $r$ is a sub-region of a region $x$ is exactly located at (e.g. the Kuiper Belt is partially located where one of the asteroids composing it is; a cube is partially located where one face of it is).

$x$ is partly located at $r =_{df}$ $x$ has a proper part which exactly occupies $r$ (e.g. the Kuiper Belt is partly located where one of its asteroid components is; if the cube has a two-dimensional part that is its face, it is partly located where the face is).

(These relations differ. An extended simple exactly occupies one region, partially occupies infinitely many, and partly occupies none.)[2]

Given **Properties Are Located** *where* are properties located? Given their location is, presumably, intimately connected with the location of their instances, one might say:

**Singular Location:** A property is exactly located at (and only at) the fusion of every region that its instances are exactly located at.

(Where $x$ is a fusion of the $y$s $=_{df}$ (i) each $y$ is a part of $x$ and (ii) no part of $x$ fails to overlap a $y$.)

If properties were fusions of their instances or their tropes, or were sets of their instances and sets were exactly located at the union of their instances' exact locations, **Singular Location** would be true. Some realists endorse it also: Bigelow [1988: 18-22] and Parsons [2007] both believe universals are partless mereological simples that are 'wholly present' where their instances are in that they aren't *partly* located where an instance is.

But not every immanent realist agrees, instead treating properties as being analogous to time travellers. Imagine Marty travels back in time to stand next to his earlier self. He is now in two places at once, being exactly located both where his earlier and future selves are. Some believe properties can manage similar feats, endorsing:

**Multiple Location:** A property is multi-located at (and only at) those regions exactly occupied by its instances.

Where we define:

$x$ is multi-located at the $r$s $=_{df}$ there are at least two $r$s and $x$ is exactly located at each $r$.[3]

Given **Multiple Location** a property is 'wholly present' where its instances are in that it is exactly located where its instances are. As we've assumed that there's an intimate connection between a property's location and that of its instances, assume henceforth that one of **Singular Location** and **Multiple Location** must be true.

The difference between **Singular Location** and **Multiple Location** has rarely been noted; indeed, endorsements of **Multiple Location** are rarely explicit. There are five reasons for

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[2] This chorological system is basically that offered by Gilmore [2008: 1228] and McDaniel [2007: 132-33] (although McDaniel uses 'occupation' instead of 'exact location'). Alternative chorological systems include those by Parsons [2007] and Hudson [2006: 97-122]. Parsons doesn't recognise 'exact location', instead using that as a name just for maximal partial location (making multi-location impossible, so it's irrelevant for the purposes of this paper). Hudson has a variant primitive of location (and I sympathise with Parsons [2008] in that I can't make sense of it).

[3] Note, therefore, that a multiply located entity will (almost always) fail to be exactly located at the fusion of those regions it is exactly located at. Barker and Dowe [2003] assume otherwise: that multi-locators must be exactly located at such a fusion. This is because they conflate (or mistake) the relation of exact location with the relation of 'entirely filling up' (where $x$ entirely fills up region $R =_{df} R$ is the fusion of some regions $x$ is partially located at); multi-located entities always entirely fill up the fusion of the regions they exactly occupy – there is no reason, though, to think they must also exactly occupy it.

nonetheless thinking that immanent realists generally have **Multiple Location** in mind when they say universals are 'wholly present' in many different places. First and second reason: The arguments for universals being 'wholly located' in many places implicitly signal that **Multiple Location** was the intended conclusion. First: immanent realists explicitly argue that universals are wholly present in multiple places because they have multiple instances (e.g. Armstrong [1988: 110] and MacBride [1998: 207, 214];[4] Lewis, whilst not a card carrying immanent realist, believed likewise [1986: 64]). But only one instance is needed for properties to be 'wholly present' in the Bigelow/Parsons sense of not being partly located anywhere. If Eve were the only human being, and exactly occupied *R*, *humanity* would be exactly located at *R*, ergo partially, but not partly, located at the many sub-regions of *R*. Therefore, with only one instance, *humanity* would be 'wholly present' (in the Bigelow-Parsons sense) at multiple regions. So if the immanent realist believes multiple instances demand a property is 'wholly present' in many places, they must intend to endorse **Multiple Location**. Second: The arguments for **Multiple Location** to be discussed below are *prima facie* plausible only when **Multiple Location** is their intended conclusion. Such arguments are (I say) unsound, but nevertheless show that their proponents mean to endorse **Multiple Location**. Third reason: Opponents of immanent realism usually assume that immanent realists believe **Multiple Location** e.g. Bar-Elli explicitly thinks **Multiple Location** is more plausible than **Singular Location** [Bar-Elli 1988: 120-21] and Gilmore [2006: 201, 232*n*36], Hudson [2005: 104] and McDaniel [2007: 133*n*5] all take immanent realists to believe **Multiple Location**. Fourth: Some immanent realists implicitly endorse **Multiple Location**. For instance, Hawthorne believes that *Redness* is six feet away from itself [1995: 192], and that this is a notable and strange feature of his theory. However, it is only notable and strange if *redness* is multiply located, for given **Singular Location** *redness* is only six feet away from itself innocuously, in the same way that I am (innocuously) six feet away from myself in virtue of the head-shaped region I partially occupy being six feet away from the foot-shaped region I partially occupy. Fifth: At least one immanent realist explicitly endorses **Multiple Location**. Laurie Paul, in private correspondence, has said that when she says properties are multi-located [e.g. Paul 2006: 632] she is endorsing **Multiple Location**.

## 1.2 Spatiotemporal Chorology

I have spoken only of properties and their spatial location (relativised to a time), but you may worry that we should be concerning ourselves with their *spatiotemporal* location i.e. what spacetime regions they exactly occupy. For instance, given perdurantism and the mereological simplicity of properties (both views of, say, the early Armstrong) properties have *no* spatial location for given (standard) perdurantism *x* is *R*-related to *y* at *t* iff *x*'s instantaneous temporal part at *t* is *R*-related to *y*'s instantaneous temporal part at *t*; as mereologically simple properties have no temporal parts they have no spatial location either and can only have a spatiotemporal location.

Whilst it's true that we may wish to focus on spatiotemporal chorology instead of the spatial variety, I will tend to talk solely in terms of temporally relativised spatial location for ease of presentation – the arguments presented below can easily be tweaked to apply to the

[4] Although elsewhere [1998: 207, 221] MacBride instead sides with the Bigelow/Parsons view of universals. Such discrepancies just reinforce how thoroughgoing the conflation of **Singular Location** and **Multiple Location** has been in previous years.

spatiotemporal version as well. But this is not the last to say about this distinction; we will return to spatiotemporal chorology, specifically spatiotemporal multi-location, below in §3.2.

### 1.3 Singular Location is *ceteris paribus* true

The argument of this paper is that **Singular Location** is true because: (i) it is *ceteris paribus* preferable to **Multiple Location**; and (ii) there is no motivation for **Multiple Location**. If (i) and (ii) are both true then **Singular Location** must be true. §§2-3 detail my support for (ii) and constitute the bulk of this paper. My defence of (i) is shorter and is dealt with in this sub-section.

The argument for believing we should *ceteris paribus* favour **Singular Location** is that if exact location is a perfectly natural relation, and we think it's a theoretical virtue to minimise the instantiations of such relations, **Singular Location** is clearly the default option. Both conjuncts of the antecedent are plausible. Take them in reverse order:

Defending the parsimony of property instantiations

If one theory says some particles, the *p*s, are charged and the second theory says that the *p*s plus some additional particles are charged, and both theories are equivalent in all other respects (such as ideology, explanatory power etc.) we should then favour the former for, just as it is standard to think that we should *ceteris paribus* favour theories with less kinds of entities, or less quantity of entities [Nolan 1997], it seems a natural extension to *ceteris paribus* favour a theory with less property instantiations in it. To believe that more particles were charged without any reason would be straightforwardly profligate – why think more things than need to be charged are charged? (The motivation becomes even clearer if, along with including properties in your ontology, you also reify the instantiations of those properties as tropes – *a la* Cook Wilson [Armstrong 1989*b*: 17; Marion 2009], Lowe [2006], Mertz or Ingarden [Johansson 2009: 76] – for in adding in extra tropes we explicitly offend quantitative ontological parsimony.)

Defending that 'Exact Location' is a natural relation

It is scientifically relevant where things are [*cf* McDaniel 2007: 132] so presumably exact location will feature in our scientific theories. If it features in our scientific theories, this indicates that it's a natural relation. One may worry that this claim is naïve, demonstrating a crass understanding of contemporary physics. We might, for instance, believe that our best scientific theory will feature a chorological relation but not 'exact location'. Imagine our best scientific theory only seemed to take note of which regions were 'filled' by matter rather than which were 'exactly occupied' by some object (where region *r* is filled iff it is the fusion of some regions, each of which is partially occupied by something). However, it is analysed in terms of exact location and it seems natural to assume that analysans are at least as natural as their analysandum. So whilst 'filling' might, in virtue of appearing in our best scientific theory, be natural, 'exact location' must be as least as natural. (Note that appearing in the best scientific theory is thereby sufficient, but not necessary, for being natural.) And this point generalises beyond just the example of 'filling'. It is irrelevant what chorological relation features in our best science as it's impossible to define 'exact location' in terms of any other chorological notion – 'exact location' will always feature as a primitive. Attempts to avoid taking it as primitive, and analyse it in terms of some other chorological relation (e.g. '*x* is exactly located at $r =_{df} r$ is the fusion of every region *x* is partially located at' [Parsons 2007]

or '$x$ is exactly located at $r$ =$_{df}$ $x$ fills $r$ and no region that isn't a sub-region of $r$') erroneously end up defining 'maximal partial location' and, as we assume that multiple location is possible, exact location cannot be maximal partial location (as there's a difference between an object being – multiply – exactly located at two regions $r$ and $r^*$, and being – singularly – maximally partially located at their fusion $r$+$r^*$). So the lesson about 'filling' generalises: if the best scientific theory features any chorological notion, we should think exact location is a natural relation.

An alternative reason for thinking exact location doesn't feature in our best scientific theory (and thereby isn't natural) is because some fundamental physical theories don't involve any chorological notions whatsoever. Quantum field theory, with its natural supersubstantivalist reading [Schaffer 2009*a*: 142-44], might be one such example. Standardly, a supersubstantivalist can do without any chorological primitive by, e.g., analysing exact location as '$x$ is exactly located at $r$ iff $x = r$'. But this standard move is of no help here as it rules out the possibility of multiple location since multi-location would then demand an object is identical to two or more distinct regions (which is impossible). (Presumably a supersubstantivalist will fix this by introducing, as an additional primitive, 'exact location' – but we've then failed to eliminate chorological notions from our theory.) Other theories are also problematic e.g. quantum gravity theories whereby spacetime itself emerges from non-spatiotemporal features of a fundamental quantum world (see Huggett and Wüthrich [2013] for discussion). Again, no chorological features appear in the theories. However, such theories are speculative, so it is of no huge concern to me if we limit the conclusions of this paper only to those who deny them. Moreover, we might still think exact location was a natural relation even though it doesn't feature in the fundamental physical theory just in the same way that we might think stellar dynamical properties were natural even though astrophysics isn't a *fundamental* physical theory. Some demure, thinking that what is less fundamental is correspondingly less natural (e.g. Lewis [1983: 247] or Sider [1995: 362]), but the alternative I'm suggesting here – that properties/relations featuring in all sorts of scientific theory, not just the fundamental scientific theories, are all natural – is not wholly implausible (see Schaffer [2004] for arguments for just such a thesis; see also Dorr and Hawthorne [2013: 18-19]). Certainly fundamentality and naturalness do not always go hand in hand: stellar properties stand at one end of a, presumably quite long, chain of ontological dependencies, ultimately depending on more fundamental properties like *being a charm quark* or *being a strange quark*, but it strikes me that stellar properties are more natural than disjunctive properties which are linked to the more fundamental properties by a much shorter chain of ontological dependencies like, e.g., the property *being a charm quark or a strange quark*. Naturalness and fundamentality, then, do not mirror one another perfectly.[5] In conclusion,

[5] This means, though, that exact location would be derivative, and some philosophers (Baron [Forthcoming] and Schaffer [2009*b*: 361] *inter alia*) think we should ignore the theoretical costs of derivative entities (at least *vis-à-vis* parsimony). We might, analogously, think that the parsimony of derivative property/relation instantiations is just as irrelevant, which then disarms us of any reason to believe we should favour a theory with the least number of property instantiations. However, those philosophers who disregard derivative entities seem to be unabashed if **All Properties Are Located** is false in the first place (for instance, Schaffer is explicit that he does not worry about the location of derivative entities [2009*b*: 361]) so such philosophers are unlikely to be caught up in the dialectic of this paper in the first place.

the claim that exact location is a natural relation might be denied by some, but the case for it is a strong one.

Thus the case for both conjuncts has been made as well as the case for thinking we should default to thinking that **Singular Location** is true.

### 1.4 Arguments for locating properties

The rest of the paper will argue that there's no reason to endorse **Multiple Location** (ergo, given §1.3, we should believe **Singular Location**). This will be achieved by undermining the extant motivations for **Multiple Location**. Start by considering arguments for properties being located in general. Most arguments for properties being located in space and time are neutral over which regions they exactly occupy and aren't specifically a motivation for **Multiple Location** (or, indeed, **Singular Location**). *Example One:* Armstrong's thoroughgoing naturalism is satisfied whether properties are singularly or multiply located. *Example Two:* Medieval philosophers sometimes anchored properties in time as God is so anchored [Bosley and Tweedale 1997: 341-44], so in contemporary circles that would translate to them being in spacetime, but there's – again – no difference as to whether they're singularly or multiply located. *Example Three:* If they must be located in order for us to have epistemic access to them, it again makes no difference. I might not be able to see *all* of a singularly located property (e.g. I can't come into contact with every electron so can never see all of *charge* were it to be singularly located) but I can be directly acquainted with it even so. Compare: I am directly acquainted with many people without, thankfully for all concerned, having seen their lower intestine – being acquainted with a person doesn't demand seeing all of them. A possible rejoinder is that this is because acquaintance just demands that I see all of a part of something to be acquainted with it (permitting me to be acquainted with people but not singularly located, mereologically simple, properties). But that just seems false. Imagine an extended simple the length of the solar system soaring through the heavens above me; the first instant I look at the region of space that would have been occupied by its tip if only it had parts would be enough to acquaint myself with it. Generally then, arguments for locating properties don't double as arguments for **Multiple Location**. There are, however, exceptions. §§2-3 discuss those exceptions which appear to motivate **Multiple Location**, and explains why those arguments do not work.

## 2. Undermining the Motivations for Multiple Location I

### 2.1 Analysing instantiation

Consider the following analysis of instantiation:

> **Instantiation ↔ Location:** *x* instantiates a property *y* iff *y* is exactly located at the same region *x* is exactly located at.

**Instantiation ↔ Location** is likely to be attractive for three reasons. *Reason One:* It avoids instantiation being 'mysterious' (Heil [2003:131] says just this, whilst Armstrong [1978: 66] has a general demand that instantiation needs to be analysed – albeit Armstrong thinks it's a different analysis that best meets that demand). *Reason Two:* As in other arenas, providing an analysis affords us some measure of ideological simplicity (Russell [1912: 23] suggests something along such lines). *Reason Three:* If we both accepted bundle theory and that the compresence of

properties was just the co-location of properties (see, e.g., Hawthorne and Cover [1998: 214*n7*]) **Instantiation ↔ Location** follows.[6]

If we believed **Instantiation ↔ Location** we should believe **Multiple Location**. The left-to-right conditional, **Instantiation → Location**, entails it for if a property has multiple instances it is exactly located where those multiple instances are. Further, its converse – **Location → Instantiation** – entails **Singular Location** is false which (given the above assumption that one of the two principles is true) entails **Multiple Location**: given **Singular Location** the property *mass of 0.51 MeV* exactly occupies the fusion of all of the regions that every electron exactly occupies; *mass of 0.51 MeV* would then be co-located with the fusion of all such particles; therefore (given **Location → Instantiation**) the fusion of all electrons instantiates *mass of 0.51 MeV*. This is false as the fusion of all electrons has a mass greater than each individual electron [*cf* McDaniel 2007: 133], so **Singular Location** must be false given **Location → Instantiation**.

Fortunately **Instantiation ↔ Location** isn't true as the right-to-left conditional is false. *Reason one:* If a sphere is charged it instantiates *spherical* and *charge*. But **Location → Instantiation** means that not just the sphere is charged but so is *spherical* itself. Clearly that's false. *Reason two:* Co-located objects such as superposed bosons, statues and distinct lumps of clay or the (metaphysically possible) case of ghosts interpenetrating matter, produce counterexamples. Given **Location → Instantiation**: two bosons with a different spin will have conflicting spins when they superpose; the statue and lump cannot have different modal or persistence profiles; ghosts/wall portions would become physical/ectoplasmic when a ghost walked through a wall. All are clearly false.

Of course, if **Instantiation → Location** were true we'd still have a problem, but given the converse is lost we cannot analyse instantiation, which is the supposed motive for endorsing these conditionals. With that motivation lost to us, there's no reason to accept just the left-to-right reading of it.

## 2.2 The Sailcloth Dilemma

Plato's *Parmenides* introduces the Sailcloth Dilemma (see also *Philebus* 15b-c and Boethius's *Isagogen Porphyrii commenta*). One of the horns argues that properties cannot be singularly located, which (assuming we avoid the other horn – not discussed here – which alleges that they cannot be multiply located either) would be reason to believe **Multiple Location**.

Socrates begins by comparing a singularly located property to a day or a sail. Just as only a part of the sail is where any individual sailor is, only a part of the property is where each instance is (if properties were, like the immanent realist thinks, mereologically simple, we could resist this move

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[6] Indeed, if **Multiple Location** were true this would then avoid a mooted problem for just such an analysis. The alleged problem for compresence being co-location is that if there exists a red sphere and a red cube, *redness* is compresent with *spherical* and *redness* is compresent with *cubical*, but as compresence is co-location then, as co-location is transitive, we get the absurdity that *cubical* is compresent with *spherical* i.e. that there's a spherical cube [Demirli 2010: 11]. However, once we accept that things can be multiply located we see that co-location isn't transitive: a ghost can be co-located with one person at one time, travel back in time and be co-located with another man at that same time, but the two men aren't thereby co-located [Effingham 2013: 332-33]. Co-location isn't transitive and there is no need to believe in spherical cubes. Similar reasoning to this should undermine other arguments against immanent universals, like Ehring's worry that universals can both be and not be two metres away from themselves [2002] – this is only as worrying as Barack Obama travelling in time to Sydney on the day of his first inauguration, so he is both zero miles from Washington D.C. and 7,815 miles from Washington D.C. [*cf* Gilmore 2003]

– but let's play along for now). At this stage Parmenides says that 'things that partake of them would partake of a part; no longer would a whole form, but only a part of it, be in each thing' (translation by Gill and Ryan [1996: 133]). Parmenides is effectively arguing that, given **Singular Location**, we should believe:

> **Only Parts Are Instantiated:** An instance (i) does not instantiate the property and (ii) only instantiates that part of the property that is exactly located where the instance is exactly located.

This principle would be a problem, although not for the reason Parmenides believes (that the property *small* would be larger than the parts which small instances instantiate and so *small* would be large – this isn't a problem as the Platonic principle that all properties self-instantiate has little contemporary support [*cf* Armstrong 1978: 71-72]). Instead, it's problematic because our theory of properties is sunk as soon as we accept the first conjunct, for then putative instances won't be instances! The second conjunct is simply redundant (which also explains why, above, I ignored the possibility that properties were mereologically simple).

To accept **Only Parts Are Instantiated** Parmenides must believe that an instance only instantiates those things that are exactly located where the instance is exactly located at. But that's just to endorse **Instantiation → Location**. As discussed in §2.1, there's no independent reason to endorse that principle. Perhaps, though, Parmenides intends the analogy itself (to sailcloth and days, although we'll stick with sailcloth for purpose of argument) to motivate us towards believing **Instantiation → Location**. If we think sailors are like instances, sails are like properties, and the relation '__ precisely covers __' (holding between sailcloth parts and sailors) is like instantiation, then **Instantiation → Location** follows. But the analogy is not compelling. A sail is exactly located at a non-scattered region, being partially located in many regions where no sailor is; singularly located properties will be exactly located at scattered regions and are never found where an instance isn't. A sail can fail to cover any sailor; no immanent property can fail to have instances. The relation '__ precisely covers __' is asymmetric; instantiation is not. So sails and properties seem very dissimilar and, short of stipulating that – in spite of those differences – they are analogous when it comes to the pertinent respects above (and why would we accept such a stipulation?) there is no argument here for **Instantiation → Location** (nor, then, **Only Parts Are Instantiated**).

# 3. Undermining the Motivations for Multiple Location II

## 3.1 The Constituency Motivation for Multiple Location

The final argument depends upon the idea that properties are not just instantiated by objects, but are also constituents of them (which, it is worth noting, is not a belief held by every realist – see, e.g., van Inwagen [2011] or Gilmore [Forthcoming] who both dislike the idea of constituents). Paul [2002: 583] believes that this leads to **Multiple Location**. There's no explicit statement of that argument but this section provides a plausible construction of it. It depends upon constituency being a lot like mereological parthood, such that (usually or always) what is true of mereology is true of constituency. Certainly many constituent theorists do believe this; some even go as far as saying constituency must itself be mereological (Paul [2002] explicitly does this, whilst Lewis [1986: 64] and Sider [2006: 387-88] both characterise constituency as

mereological; it further has roots in Greek philosophy for it is endorsed by Anaxagoras and Eudoxus [Fine 1986: 72]).[7]

If there is such an analogy then as:

> **Part-Location Inheritance (PLI):** If *y* is a part of *x*, and *y* is exactly located at region *r* then *x* must be partially located at region *r*.

is true, the following analogue principle would be true:

> **Constituent-Location Inheritance (CLI):** If *y* is a constituent of *x* and *y* is exactly located at region *r* then *x* must be partially located at region *r*.

Given **CLI**, **Multiple Location** is true as **Singular Location** is inconsistent with **CLI**. To demonstrate: electron *e* instantiates *charge*; given **Singular Location** *charge* exactly occupies the fusion of the regions exactly occupied by every charged particle; given **CLI**, *e* must partially occupy the fusion of the regions exactly occupied by every charged particle i.e. be partially located where *every* charged particle is; this is false, thus **Singular Location** is inconsistent with the conjunction of (i) properties being constituents of their instances and (ii) constituency being analogous to mereological parthood. You might worry that *charge* being multi-located at many regions doesn't help as *charge* still partially occupies regions where *e* clearly isn't (Lowe [2006: 99] has such worries, and repudiates **Multiple Location** – and located properties in general – because of this). But compare multi-located properties to multi-located time travellers. Imagine early Marty was healthy in 1986 but in 1990 received a kidney transplant from his father. If his future self comes from 2016 to 1986 then his future self will have his father's kidney as a part. Strictly speaking **PLI** demands that, as Marty has his father's kidney as a part in 1986 (for his future self is there, with his father's kidney), then as the kidney is *also* a part of his (non-time travelling!) father in 1986, Marty should be partially located at a place where his father is partially located (i.e. that kidney shaped sub-region of the place his father is exactly located at). As this is false, we should instead tweak **PLI** so that an object only inherits the location of the 'version' of any multi-located entity that it has as a part (so Marty only inherits the location of the future version of the kidney, not the location of the version his father has as a part). Given that tweak, we should say analogous things about **CLI**: multi-located objects only inherit the location of the relevant 'version' of the multi-located property that they have as a constituent. So *e* doesn't inherit all of the exact locations of the property *charge*, just the exact location of the version it has as a constituent. Thus **Multiple Location** is consistent with properties being constituents of their instances and constituency being analogous to mereological parthood.[8]

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[7] The transitivity of parthood would pose a special problem if constituency were like parthood, for constituency isn't usually thought to be transitive and, ordinarily, we instantiate every property we have as a constituent (so I'd, e.g., instantiate *being a property* as it is a constituent of one of my constituents). I'll – charitably! – ignore this problem within this paper (if it worries you unduly, that's *more* reason for thinking this argument for **Multiple Location** does not work!). However it bears noting that we might: (i) doubt that parthood is transitive (which I think it an under-developed line of discussion – see Varzi [2014: §2.1] for a mini-survey); or (ii) have a sparser ontology that avoids such tricky properties as *being a property*.

[8] I remain silent over what the multi-locator says about the ontological status of a property's versions. They might offer a paraphrasing scheme for them; they might identify them with tropes; given that 'versions' of objects are probably best identified with temporal parts, they might say likewise and maintain that properties perdure. I don't care what they do. Given that *they* need 'versions' for *their* theory to work, I'm happy to charitably grant multi-locators 'version' talk without worrying about this particular issue. If you think it is a serious problem, then all the better for **Singular Location**!

The argument is a compelling one if we accept the assumptions. Fortunately, I believe we can develop independent reasons for thinking that (given **Properties Are Located**) we should not think both that properties are constituents of their instances and that constituency is analogous to mereological parthood. §3.3 explains why that conjunction is untenable given a sparse ontology of properties; §3.4 does the same but for an ontology with abundant properties. But first we need a preamble defence of two principles that will be crucial to discussing the problem (discussed in §3.2).

## §3.2 Two Constituency Principles

The argument requires two principles to work. The first principle is

> **All Properties Are Constituents:** If *x* instantiates *Fness* then *Fness* is a (proper or improper) constituent of *x*.

I assume that this is a fairly pedestrian demand (Loux, for instance, thinks it's true of the traditional constituent theorist [2006: 225], and Wildman [Forthcoming] and Bailey [2012: 32] both talk as if it's obvious), and it seems *ad hoc* to think that only some properties are constituents of an instance whilst others are not. It also follows from various motivations for thinking that properties are constituents of their instances. For example, if we analyse away instantiation using constituency talk (indeed, Paul [2002: 584] toys with doing just that) by saying, e.g., '*x* instantiates *Fness* $=_{df}$ *Fness* is a constituent of *x*', then **All Properties Are Constituents** is obviously true as it amounts just to the left-to-right reading of that analysis. Similarly, if we follow Armstrong and use constituency to help avoid the instantiation regress (albeit, Armstrong thought properties were constituents of states of affairs, not instances) then such a move equally demands every instantiated property to be a constituent of its instance. Or we might think properties are constituents because of epistemological concerns (along the lines that the British Empiricists were worried about [*cf* Armstrong 1989: 60-64; Denkel 1989]) such that, as we're only acquainted with an object's properties, an object must be identical to a bundle of those properties. But in that case, as there seems to be no empirical evidence as to whether any given property an object instantiates is or isn't a constituent of the object, these empirical demands seem to drive us towards thinking that every instantiated property is a constituent of an instance (for if it has to be that at least some properties are constituents, and there's no empirical way to divine which are or are not, we'd better assume all are if we are to maintain our empiricist scruples). In short, the motivations for thinking that properties are constituents double as motivations for accepting **All Properties Are Constituents**.

The second principle that I need, and which I also think is uncontentious, is:

> **Things Instantiate What They Are:** If *x* is F, and F corresponds to a property *Fness*, then *x* instantiates *Fness*.

Whilst something can fall under a predicate without instantiating a corresponding universal in cases where there is no universal it corresponds to (e.g. in a sparse ontology of properties Elvis is a rock star without instantiating *being a rock star*) it seems strange for anything to fall under a universal corresponding predicate without instantiating the universal. For instance, if '__is point sized' corresponds to the property *point-sized* it'd be odd for something to be point-sized without instantiating the corresponding universal. Compare: how odd it would be if, say, all electrons were charged but some were charged because they instantiated *charge* and some were charged

because… well, just because. You may as well just drop *charge* from your ontology if some electrons can be charged without it![9]

Below I'll deploy this thinking in the case of geometrical properties: if the predicate '__ is point sized' corresponds to a universal then every point sized thing should instantiate it. This would mean that the properties that exactly occupied (e.g.) point-sized regions, and were themselves point-sized (for anything that exactly occupies a region has its geometric properties [McDaniel 2007: 135; Skow 2007]) would also instantiate *point-sized*. Here you might start to cast doubt on **Things Instantiate What They Are**. One referee did just that, suggesting the following:

> **Shape Properties Are held Derivatively (SPAD):** Where F is a universal-corresponding predicate, *x* is F iff *x* instantiates *Fness* or, in the case of geometric properties, *x* either instantiates *Fness* or is co-located with something that instantiates *Fness*.

Given **SPAD**, in a substantival world with regions, a region instantiates *point-sized* whilst the particle (and properties) that exactly occupy it are point-sized derivatively in virtue of being co-located with the region. In a relationist world lacking regions (a world in which all chorological talk is translated into some region-neutral analogue) the particle instantiates *point-sized* but the properties instantiated by the particle are derivatively point-sized in virtue of being co-located with the particle. So if **SPAD** were true, **Things Instantiate What They Are** would then be false.

But **SPAD** is incompatible with the main motivation for universals in the first place: solving the issue of genuine resemblance [Armstrong 1989*b*]. *Point-sized* is a universal so point-sized things should genuinely resemble one another – if I asked you to list all of the natural classes that there were then (given *point-sized* is a universal) all and only the point sized things would be in one such natural class, and if you neglected to include some point-sized things in that class (on the grounds that they didn't instantiate *point-sized*) your natural class would have an impoverished membership. But realism says that genuine resemblance holds in virtue of instantiating the same universals, and this means that there are example cases whereby – given **SPAD** – some point-sized things wouldn't genuinely resemble some other point-sized things. And that's not right at all! *Example One:* An intra-world example. A region instantiating *point-sized* doesn't share any universals with the particle exactly located at it, nor with the properties co-located with it. But they're all point-sized things, so should all genuinely resemble (to some degree). *Example Two:* An inter-world example. A point sized particle at one world should genuinely resemble a point sized particle at any other world. But substantivalism is commonly thought to be contingent [Earman 1989: 14; Miller 2010] and I see little reason to argue. In a substantival world particles won't instantiate *point-sized* (although the regions they exactly occupy will) whereas in a relationist world particles will instantiate *point-sized*; the particles end up not sharing a universal, and not genuinely resembling, when they should genuinely resemble. *Example Three:* An intra-world example. Given substantivalism is contingent, imagine an exotic world where one half is substantival, and the other half is not. (I admit it's a weird world, but if regions are contingent I have a hard time

[9] It's **Things Instantiate What They Are** which causes problems for substrata theorists wanting abundant properties as they then have to have it that because particulars instantiate no properties they instantiate *not having any properties* and are not thereby bare (obviously the problem is dissolved in an ontology with sparse properties [Sider 2006: 392]).

thinking it's an impossible world.) A point-sized particle in one half would, again, not genuinely resemble a point-sized particle in the other half. And that's not right. Accepting **SPAD**, then, would be a concession I doubt few realists would be willing to make. So we shouldn't think, in the dialectic we are currently caught up in, that there are any exceptions to **Things Instantiate What They Are**.

### 3.3 Problems for Sparse Property Ontologies

With those two principles in place, we can turn to the problems facing the conjunction of: **Properties are Located**; **All Properties Are Constituents**; and there being an analogy between constituency and mereological parthood. The specifics depend upon whether we think there are only sparse properties or whether properties are abundant. This section deals with the issues concerning a sparse ontology.

Given a sparse view of properties there could be a world with only two properties, e.g. *charge* and *point-sized*, such that some point sized things are charged and some aren't. But, given bundle theory, the particles that aren't charged only have one constituent (namely *point-sized*), which is analogous to a situation of having just one proper part. (See also Schaffer [2003].) But even the weakest mereologies rule out objects having one proper part [*cf* Simons 1987: 28-31]. Thus, if this were possible then there'd be no mereological/constitutional analogy, which undercuts the original move from **PLI** to **CLI** and gets us out of the argument for **Multiple Location**.

Objections to this problem are: (i) that substratum theory is true (and all things have more than one constituent); (ii) deny that mereology prohibits objects with only one proper part, so the analogy still holds even in light of the example case; (iii) in cases like the example, identify the property with the object so it now has no proper constituents rather than one; (iv) deny that the example case is possible by denying that *point-sized* can be a sparse property.

*Objection One:* Given substratum theory the uncharged particles will have two constituents, namely *point-sized* and a bare particular.[10] However, the existence of substrata is in tension with locating properties, for every reason to locate properties (naturalism, demands concerning epistemic acquaintance etc.) is presumably also a reason to locate substrata. If a substratum was anywhere it'd presumably exactly occupy the same region as its host. It follows that the substratum must be point-sized. Assuming, as we have, that *point-sized* is a property, then **Things Instantiate What They Are** entails that the substratum instantiates a geometric property and is no longer a bare particular.[11]

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[10] We also need to believe **All Substrata are Constituents** (the thesis that if *x* is *y*'s substratum then *x* is a proper constituent of *y*). Not everyone does believe this [Connolly Forthcoming].

[11] Wildman [Forthcoming] divides instantiation into two varieties: possessing (whereby objects possess properties) and bearing (whereby the substrata of objects bear properties). To be bare is to not possess properties. Wildman [*sic*] suggested this machinery could avoid my objection for we could claim substrata merely bear, and do not possess, the geometric property. However, the thinking behind **Things Instantiate What They Are** justifies that things *possess* the properties corresponding to how they are. Otherwise substrata and their hosts wouldn't – *qua* geometric properties – genuinely resemble (which they clearly do) as genuine resemblance is about possessing the same properties (and thereby having them as constituents). A complaint may be that genuine resemblance is a case of possessing or bearing the same properties, but then every substratum perfectly resembles its host and I fail to see how we get out of Bailey's 'Overcrowding Objection' [2012]. I suggest that the only option for substrata theorists is to deny **Properties are Located** (and thereby rescue unlocated substrata).

*Objection Two:* Perhaps you are liberal about mereology and believe that an object can have but one proper part. I find that hard to envisage.[12] Someone might nonetheless defend this possibility, but if I am to be expected to accept that, in spite of my inability to conceive of it, there can be objects with just one proper part, why can't I say the same of denying **PLI** (and, by extension, denying **CLI**)? Once you have taken me to a place where I can deny the intuitive mereological principle that composite objects must have more than one proper part, I would be hard pressed to see why I am not also in a place where I can deny **PLI** (thence deny **CLI**). For example: if you endorsed a very liberal principle of recombination it'd be quite reasonable to think objects could have but one proper part, however – as detailed by Saucedo [2011] – such liberal principles will then entail that **PLI** is also false.

*Objection Three:* One might deny that the particle is distinct from the property in the example case, and that *point-sized* is identical to the particle. (A referee, who raised this issue, likens it to Hawthorne's [1995] position on bundle theory.)[13] But imagine a charged, point sized particle. It instantiates *charge* and, given **Multiple Location**, *charge* is exactly located where the point-sized particle is, and so is point sized. Given **Things Instantiate What They Are**, then as *charge* is point sized, and *point-sized* is a property, *charge* instantiates *point-sized*. Given **All Properties Are Constituents** we have restored the problem case for there is now an entity that has but one constituent (though now it is the property *charge* having *point-sized* as its sole constituent rather than a particle having *point-sized* as its sole constituent). Nor can we redux the same move, and say that the instance is identical to the sole property it instantiates, for clearly *charge* is distinct from *point-sized*.

*Objection Four:* If *point-sized* was not a property, the example would not work. But it looks likely that *point-sized* will exist. Any plausible principle about what sparse universals exist will, at the least, reify properties featuring in the most fundamental physics and it's plausible that *point-sized* features in that theory (or, if not *point-sized* then some geometrical property like *being a line* – see Maudlin's topology built from a theory of linear structures wherein such properties are the basis [2010]). Some theories, such as quantum gravity theories, might not be constructed like this, although it's worth bearing in mind the argument of §1.3 that featuring in *any* scientific theory, not just the fundamental physical theory, is enough for a property to count as natural, in which case – if we thought all properties that were natural existed – *point-sized* would, again, exist.

### 3.4 Problems for Abundant Property Ontologies

If properties were abundant, things would necessarily instantiate an abundance of properties and necessarily have more than one constituent – in that case, the problem of §3.3 won't be an issue. We are, though, faced by a different problem case. Take again the point sized particle instantiating *point sized*, wherein *point sized* is itself point sized and so self-instantiates. Given **All Properties Are Constituents**, *point-sized* has itself as a constituent. This is problematic. It's

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[12] Although I agree that an object can have one proper part by having many different multi-located versions of that part as parts [Effingham and Robson 2007; Effingham 2010] but that's irrelevant as the objects under consideration don't have multiple versions of the same constituent as constituents.

[13] If we then analyse instantiation in terms of constituency, we must say that *x* instantiates *Fness* even when *Fness* is its improper constituent, which entails that all properties self instantiate. So where we have an electron identical to, e.g., the bundle of compresent properties *point-sized* and *charge*, we have two things which are charged: the electron and *charge*. This doesn't mean that an electron should have double the charge, any more than a statue weighing 60kg and the plurality of atoms composing it weighing 60kg should end up weighing 120kg combined.

initially problematic because if constituency is analogous to proper parthood then, as proper parthood is asymmetric, constituency must be too (ergo *point-sized* can't have itself as a constituent). But this initial problem can be overcome by, again, offering a comparison to time travel:

> Imagine a cube, with each side measuring 10m, made of a homogeneous substance. Now combine sci-fi scenarios. Not only do we take [the cube] back to a time that it previously existed at, but we use a shrinking machine and miniaturize by a factor of 100. We then remove a cube-shaped portion, with edges measuring 10cm, from the earlier, larger version of the cube and replace that portion with the miniaturized future version (which now fits perfectly). The cube is now a proper part of itself at that time. So [proper parthood isn't asymmetric] [Effingham 2010: 335]

As something can be a proper part of itself when it multi-locates, *point-sized* can be a constituent of itself when it multi-locates. However, a 'version'-specific principle still governs the parthood relation. The future version of the cube can be a part of the past version of it, but even given time travel no version can have *that self-same version* as a proper part. Analogically, one version of a multi-located property may have a different version of itself as a constituent, but not the same version. Therefore the particle instantiates, and has as a constituent, one version of *point-sized* – call it $point\text{-}sized_1$ – whilst $point\text{-}sized_1$ instantiates, and has as a constituent, a different version of *point-sized* – call it $point\text{-}sized_2$.

That solves one problem but introduces another, for now there is no fundamental level. Given **Multiple Location**, $point\text{-}sized_2$ is exactly located where $point\text{-}sized_1$ is, and so must also be point sized. So (given **Things Instantiate What They Are** and **All Properties are Constituents**) it instantiates, and has as a constituent, a third version – $point\text{-}sized_3$. Nor does it stop there: $point\text{-}sized_3$ has $point\text{-}sized_4$ as a constituent, $point\text{-}sized_4$ has $point\text{-}sized_5$ as a constituent, and so on *ad infinitum*. Given that things ontologically depend upon their constituents then, as this chain of constituents is ever descending, there is no fundamental level to reality i.e. there is no collection of ontologically fundamental entities upon which everything else depends. Further assuming that there being no fundamental level is an indictment, it follows that either properties aren't constituents or that **CLI** is false and objects don't inherit the locations of their constituents. (You may complain that there *is* a fundamental level, and that *point-sized* is still fundamental, for it is the same property – albeit different versions of it – which features at every stage in the infinitely descending chain. I disagree. Compare to the standard worry for fundamentalism and ontological dependence: gunk. Given gunk, there is no fundamental level. Replacing every part of a gunky object with shrunken multi-located versions of itself – similar to what I do with the time travelling cube – leaves us with a gunky object that has itself as a part all the way down. But it still seems wrong to think that the cube is now fundamental. As we've assumed a mereological/constitutional analogy, the same worries apply to *point-sized*.)

Three objections to this argument are: (i) that *point-sized* instantiates *point-sized* by having itself as an improper constituent, not a proper constituent (so there is no regress); (ii) that things don't depend upon their constituents (so there is a regress of constituents but no indication that there's

no fundamental level); (iii) not having a fundamental level isn't worrisome (so the problem case just isn't a problem).

*Objection One:* Just as objects are their own improper parts, we might think properties are their own improper constituents and **All Properties Are Constituents** just demands the trivial position that self-instantiating properties are their own improper constituents. This would foreclose the regress as it needs a regress of different versions of *point-sized* to get going, and now there is only the one 'version' of *point-sized*. But, because properties are abundant, we can tweak the example case to generate a slightly different regress. If properties are abundant, sortal properties exist (e.g. *being a panda*, *being a dog*, *being an abstract object* etc.) so *being a property* exists. As *point-sized* is a property, it instantiates *being a property* and, given **All Properties Are Constituents**, *being a property* is a constituent of *point-sized*; given **Properties Are Located**, *being a property* must be point sized, and so instantiates *point-sized*, which is a property and so instantiates *being a property*. Etc. So we get a new regress. As *point-sized* is clearly not an improper constituent of *being a property* (nor vice versa) we can't redux the same objection to foreclose this regress as we did the original.

*Objection Two:* If things don't ontologically depend on their constituents, the problem would also be avoided. One way this could be achieved is if we reproached all talk of ontological dependence. But if one is happy with, the already somewhat abstruse, talk of constituency, baulking at dependence talk is unlikely; whilst, conceivably, they can come apart, I can name no actual philosopher who thinks constituent talk is intelligible and dependence talk isn't. A second way to achieve the same result is to endorse priority monism (or some close variant thereof), such that dependence runs in reverse, constituents depend upon the constituted, and the universe is the only fundamental object. However, priority monism is in tension with ontologically committing to properties in the first place. Given priority monism, the world is the truthmaker for everything, so properties are now redundant in metaphysical explanations. If you thought a good reason for believing in properties was to play such a role, i.e. solving the Problem of Universals or explaining genuine resemblance etc., you've now disarmed yourself of that motivation.[14]

*Objection Three:* Maybe there just isn't a fundamental level. This view has received some defence (e.g. Morganti [2009]) but most people find the 'turtles all the way down' approach to be undesirable. I confess that I have little to add to this debate, so rest at this stage by relying upon popular resistance to such 'metaphysical infinitism'. (More importantly, it's not clear to me that the philosophers who actually endorse **Multiple Location** will want to endorse metaphysical infinitism.)

In summary, the conclusion of this sub-section is that if properties were abundant we'd have serious problems if we accepted both **All Properties are Constituents** and that constituency/mereology were analogous. The further summary of this section is that no matter what our view about what properties there are, we should not both accept **All Properties are Constituents** and the analogy, and without both those principles there is no argument for believing **Multiple Location**.

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[14] One objection: priority monism still need properties as the universe instantiates a distributional property, and it's the state of affairs of that instantiation which is the sole truthmaker. But that property necessarily has only a single instance and so would be singularly, not multiply, located: **Singular Location** would be necessarily true anyhow.

# 4. Ramifications

## 4.1 Ramifications for immanent realism

Given §1.3 **Singular Location** is the default assumption and, given §§2-3, there's no reason to give up on that default, so immanent realists should accept **Singular Location** (indeed, anyone who reifies properties and locates them in spacetime should agree, although it's likely that only immanent realists will even be tempted to endorse **Multiple Location** in the first place). One might complain that immanent realism is defined as the thesis that properties are multiply located (MacBride [1998] calls this the 'Aristotelian approach'), so any theory accepting **Singular Location** cannot be a variant of immanent realism. Some might even go as far as saying that a universal is, by definition, a thing that is multiply located. But there are other definitions e.g. a universal is anything which has multiple instances [Mormann 2012 405; Simons and Cameron 2009: 598] or is a *sui generis* property [Oliver 1996: 25]. If we accept such a definition then, as singularly located properties can have multiple instances and can be *sui generis*, I see no reason to think that a theory whereby universals are singularly located doesn't count as a variation of immanent realism. In any case, disputes concerning definitions and terms of art can never motivate any interesting argument. If you're committed to the Aristotelian definition you should just admit that there's a new theory, 'immanent schrealism', committed to singularly located properties, and that immanent schrealism is to be preferred to immanent realism. That's still a serious metaphysical discovery.

Nor is this conclusion just of interest to those who already endorse immanent realism. For instance, those who did not think properties could be located at all because they believed it led to **Multiple Location**, which they found to be distasteful (e.g. Lowe [2006: 98-99]), will now have room to reconsider.

## 4.2 More general ramifications

Thus far this paper has assumed that multiple location is coherent e.g. by using time travel as a putative example. Not everyone agree. For instance, Parsons can only make sense of 'exact location' as 'maximal partial location' [2007: esp. 205; 2008] and Hawthorne [2006: 103-4] thinks these worries are plausible. (Donnelly [2010:203] lists more sceptics.) And this becomes more pressing if we consider spatiotemporal multi-location – at least with the example of time travel we have a good idea what spatial multi-location (relativised to a time) amounts to, which does nothing to help us understand spatiotemporal multi-location. Obviously charity demanded that I previously ignore such worries above (lest **Multiple Location** die a death without a fight) but now I have room to reconsider, especially as the poster boy for multi-location being coherent is immanent realism. We hear similar to this: You understand what an immanent universal is don't you? So you *do* understand what it is for something to be multiply located [Gilmore 2006: 201, 232*n*36; Hudson 2005: 104; McDaniel 2007: 133*n*5]. More explicitly: if a plausible theory says X is the case, then X is (at least) coherent, and as immanent realism (which we'll take to be the conjunction of **Properties are Located** and **Multiple Location**) makes for a plausible theory, multiple location is a coherent notion.

Given what I've said, this argument no longer works, for the addition of superfluous principles to an otherwise plausible thesis/theory doesn't mean that the added principle is then plausible or coherent. Compare to the French Infinitesimalists who believed that calculus required there to be

things which were 'zero and not zero'. (Vickers [2013] summarises the debate.) Imagine a contemporary arguing that because calculus made sense, and (according to French Infinitesimalism) calculus required infinitesimals, these *prima facie* contradictory mathematical objects were plausible *a fortiori* coherent. When it's then revealed that calculus can proceed without infinitesimals, and that infinitesimals are an implausible, extraneous add-on to the otherwise plausible theory of calculus, their plausibility/coherence is no longer guaranteed by the plausibility of calculus. The same applies here: **Multiple Location** is an extraneous addition to any theory locating properties in spacetime, so any plausibility extended to immanent realism should only be extended in virtue of it involving properties being located – it should not extend to properties being multiply located.

This isn't to say that multi-location isn't coherent (you might – correctly – guess that I believe spatial multi-location is coherent, as ably demonstrated by time travel cases; I am far more suspicious, though, of spatiotemporal multi-location). It only means that demonstrating its coherence to those currently unpersuaded is that much harder. Henceforth, let any argument in this territory proceed without reference to immanent universals and their alleged ability to pull off the feat of multi-location. And this debate is not a narrow, esoteric debate – a lot is at stake over whether or not multi-location is coherent or not for the issue bears directly on the metaphysics of persistence. Endurantism is often cashed out in terms of objects being (spatiotemporally) multiply located (for a roster, see Effingham [2012: 184-6]), so this paper threatens such versions of endurantism. This paper, then, concerns not just the metaphysics of properties but the metaphysics of location and persistence more broadly.[15]

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