Vagueness in sparseness: a study in property ontology

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Recent literature on vagueness has begun to question the sharp distinction so long maintained between 'semantic' and 'ontic' forms of vagueness (see e.g. Schiffer 2001: ch. 5 and Merricks 2001). Particularly, many writers have noted that, unless their theory of vagueness is epistemicist, those committed to 'plentiful' theories of properties seem straightforwardly committed to ontic vagueness. If the classically vague predicates like 'red' and 'bald' correspond to genuine properties, the thought goes, then those properties will likewise be vague. The non-specific application of the predicates, in fact, seems to come about in virtue of the fact that there are individuals of which it is indeterminate whether they instantiate a given property.[1] Yet many philosophers – motivated at least in part by the worry that most of our common-usage predicates are too 'loose' or 'rough and ready' to correspond to genuine properties – have argued for a much sparser conception of properties than ordinarily invoked, wherein the only truly existing properties are certain basic elements of the natural world (which basic elements they are will be a question, ultimately, for physics to decide). Among the most prevalent of these theories are the conception of properties as Universals and the particularized properties of trope theory. In the subsequent sections I will discuss whether worries of vagueness might affect these more constrained property ontologies as well. The examples I offer are not meant to be knock-down arguments or conclusive evidence that the theories in question are, in fact, committed to ontic vagueness,

[1] There is, of course, conceptual room to deny this. But the burden of proof, it would seem, is on the defender of plentiful properties, rather than the proponent of ontic vagueness.

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but simply puzzles – puzzles that I see no easy answer to and puzzles that, if persuasive, show that sparse property theories are not immune to the worries of vagueness levelled against their plentiful counterparts.

1. *Universals*

1.1 *Basic v. structured universals*

David Armstrong distinguishes between two types of Universals: basic and structured. Basic Universals are simple properties, and are irreducible to anything else. Structured Universals, in contrast, are complex properties built up out of other Universals. However, Armstrong crucially denies that structured Universals are reducible to basic Universals, because he thinks it's an open possibility that there might not be any basic Universals – that is, he thinks that every Universal might have proper parts (see especially Armstrong 1979: 32–33). Moreover, he argues that the complex Universals must be taken with ontological seriousness, because it may prove impossible to give an exhaustive description of the world without them.

1.2 *Vagueness and universals?*

So, of course, the natural question for the purposes here becomes: given the sparse conception of properties depicted in theories of Universals, do they have any problem with vagueness? Prima facie, of course, it seems that they're better off. For the Universals theorist, the classically vague predicates like 'bald', 'red', and 'heap' don't correspond to associated Universals. Instead, they're a simple language grouping based on phenomenal resemblances. Objects that fall under such groupings will more than likely share some structured Universals (how many depending on how closely they resemble one another, resemblance being a matter of having parts (Universals) in common), but there needn't be any fact of the matter about how many Universals a red object need have in common with a paradigm red object, for instance, to count as instantiating the Universal of redness, because there is no such Universal (Armstrong 1989: 84–87 and Lewis 1983: 251).

But let's take a look at the predicates that theorists like Armstrong *do* want to take seriously, the ones for which they think there are corresponding properties. These are the predicates we often use in science, predicates which are somehow 'sparse' or 'natural'. Take, for example, the property of being Einsteinium. Armstrong (and those of similar philosophical persuasions) are inclined to treat being an instance of an element of the Periodic Table with ontological seriousness, and thus to think of being Einsteinium as a genuine property. Thus, according to a theory of Universals, being Einsteinium will be a complex property, a structured Universal composed of a certain arrangement of simple Universals.

But herein lies the potential for vagueness.[2] Atomic bonds don't form instantaneously; electrons, protons, and neutrons don't just automatically switch from being independent to being part of an atom. It takes several nanoseconds for the bonds to form, and so it seems that at some point along this process it will be indeterminate whether the particles in question instantiate the property of being Einsteinium. That is, for the particles in question, there will be a point at which it is vague whether they collectively instantiate the structured Universal of Einsteinium.

Moreover, since most philosophers who believe in Universals are Aristotelian about their existence – that is, they deny that any Universal exists uninstantiated – then it seems that they are led to an even more worrying puzzle of vagueness when we consider that Einsteinium is one of the human-made elements of the Periodic Table. Einsteinium was created in a controlled situation in a laboratory, and before that point it had never existed. But, since the initial formation of Einsteinium atoms seems subject to the previous worries of indeterminacy, there appears to be a time at which it is indeterminate whether there is, *or ever has been*, any Einsteinium.

Armstrong can avoid a charge of vague existence here, because he contends that Universals have a type of atemporal existence, such that 'no uninstantiated Universals' translates to 'all and only the Universals exist which have, are, or *will be* instantiated' (Armstrong 1989: 75). So the Einsteinium Universal, for Armstrong, would exist prior to its instantiation because, in the actual world, it *will be* instantiated. But the vagueness re-enters when you stretch the case out modally. Take a series of possible worlds where the production of Einsteinium in the laboratory stops at various points during the formation of the atomic bonds. Some worlds in the series will definitely contain the Universal Einsteinium, while others will definitely not. But it seems that there will be no determinate first world which contains no Universal Einsteinium. And thus, in some worlds it will be vague whether or not *there is* a Universal of Einsteinium.

It should be noted that this is not, straightforwardly, a commitment to vague existence. It's important to distinguish between two claims:

(1) There is an x, and it is vague whether it exists.
(2) It is vague whether there is an x.

Vague existence – at least in its most robust form – would be the former, whereas the current characterization of Universals commits them only to

[2] For this thought experiment, as well as those that follow, I'll be using the classical model for the sake of simplicity; I'm assuming that nothing much will be lost by this, as they are just illustrative examples, and could be adapted or reformulated for a more modern conception of physics – needless to say, it's doubtful bringing in quantum mechanics would help to *avoid* worries of vagueness.

the latter. Still, this may be skirting far too close to vague existence for many to be comfortable (and, indeed, some may feel that (2) is enough to generate a charge of vague existence, even if it's not as robust as (1)).

Armstrong and his allies might here protest that the proffered examples of vagueness are only in complex properties – in structured Universals. The fundamental properties – and the simple universals to which they correspond – (whatever they may be) will not be vague, nor subject to any sort of vagueness. Yet so long as the simple Universals are precise, there needn't be a problem.

It's not clear, however, that the defenders of Universals can get off so quickly. Although they admit that structured Universals are composed of component simpler Universals, they still take them with ontological seriousness. The property – and its constituent structured Universal – of being Einsteinium, like other properties that will correspond to complex Universals (being H_2O, being carbon, etc), exists in a way that being red and being bald do not. They are not simply loose family resemblances that our language groups together, but rather are places where, as natural kind fans are fond of saying, 'the world is carved at its joints'. But if these properties (Universals) exist in our ontology – and not in the 'ontological free lunch' manner Armstrong is so fond of employing – then it seems the vagueness to which they are subject must be included in our ontology as well.

2. Properties as particulars – a theory of tropes

2.1 Particular properties

In contrast to believers in Armstrong-style Universals, many philosophers now defend a conception of properties as particularized individuals – often referred to as tropes. According to trope theories, various objects do not 'participate in' or 'instantiate' the same property; rather, each property is an individual existent (Oliver 1996: 34). Thus, my dog is brown not in virtue of its participation in or instantiation of the property of brownness (shared by many other brown things), but rather in virtue of having a particular, unique trope – the brownness of my dog.

2.2 Vagueness and the similarity relation

But how then am I to say that my dog resembles other brown things, if it does not share a property with them? The trope theorist explains this in terms of similarity. Two objects have the same colour, for instance, if their colour tropes are *exactly similar*. Exact similarity is the basic comparison relation for trope theories, and all other comparisons are couched in the degree to which they approach exact similarity (Oliver 1996: 35). So two objects are alike in colour if they have similar – though not exactly similar – colour tropes. And the similarity relation needn't hold only for

tropes of the same family kind; tropes of colour, for example, are more similar to tropes of shape than they are to tropes of, say, mass.

Yet, because the similarity of tropes is for the most part inexact and because the tropes are distinct existences bound by no shared properties, it seems the similarity relation will in many cases be vague. It will be indeterminate, for example, whether the trope of a molecule's mass is more similar to the trope of its shape than it is to the trope of its size. Degree of similarity between distinct tropes will, in cases such as these, be a vague matter.[3] And this, again, seems like a plausible candidate for a case of so-called ontic vagueness. It is vagueness in the world, vagueness that exists objectively in the relations among physical objects.[4]

2.3 Vagueness in trope-transition

Trope theories, however, might face further, more significant difficulties with vagueness than simple vagueness in similarity. Certain properties of objects are continually changing, and a trope theorist will have to give an account of such changes in terms of tropes. Take, for example, an object whose mass is in flux and changing rapidly. The trope theorist has two available routes of explanation here: she can either argue that, for each change in mass a new trope comes into existence (the mass of the object at 31 grams, the mass of the object at 32 grams, at 33 grams, etc. each being a distinct, non-repeatable trope), or she can claim that a single trope – the object's mass trope – exists throughout the changes and accounts for each of them (the trope changes as the mass changes). The second alternative is likely to be unpopular among trope theories, both because it would make tropes unsuitable candidates for truthmakers[5] and because it seems to be smuggling a notion of properties in through the back door – it's difficult to understand how the trope could 'change' to accommodate the change in mass without ascribing properties to the trope itself, which of course is unsatisfactory since tropes are meant to be an exhaustive characterization of properties. So trope theorists would likely opt instead for the former option – that the object changes in its tropes as it changes in its mass.

But here we have another situation that looks likely to give rise to vagueness. If the mass of the object is changing non-continuously, it might

[3] The relevant Sorites series would be of the form: '$x(1)$ is more similar to y than z'; 'if $x(1)$ is more similar to y than z, then $x(2)$ ...'

[4] It's not at all clear, however, that vagueness of this kind is particularly problematic. Admitting that tropes sometimes have vague similarity relations doesn't seem to incur the classic objections against the possibility of ontic vagueness, such as Lewis's and Sider's arguments from vagueness in number or worries of potential vague existence (see Sider 2001).

[5] The same trope would make true 'the object's mass is 31 grams' and 'the object's mass is 32 grams', which most truthmaker theories would find unsatisfactory.

be vague when one trope goes out of existence and a new one comes into being (since there might be no determinate first instant of the change in mass). Again, unless we hold something akin to epistemicism, the boundaries for 'that particular mass' will be blurry, making it likewise blurry when the original trope (e.g. the 31 gram trope) ceases to exist and the new one (32 grams) is generated.

The trope theorist might respond by saying that all tropes are instantaneous, and thus that each individual mass trope exists only for an instant, and that the next comes into being the following instant. This response, however, doesn't seem to wholly dispel the vagueness (or at least the suspicion thereof) in question. There could be a precise number of tropes in a sequence, but it be vague which tropes are change tropes[6] and which tropes are not (again, because there might be no first instant when the mass begins to change). Or, given a precise amount of time, it might be vague how many tropes there are in that time unit. For it to be precise how many tropes there are, there would have to be a fully precise, sharply-bounded smallest unit of time that would exactly determine the extinction of one trope and the generation of the next. But do we have any reason to think such precision will be present in the temporal case when it appears so lacking in the material case?[7]

2.4 Vagueness in trope existence

It might even be possible to construct a scenario similar to the Einsteinium case for Universals, where it is vague whether an object has a certain property at all. But, since trope theories particularize properties, in such a case it would not simply be vague whether they instantiate a shared concept; rather, it would be vague whether or not a trope exists to manifest that property in the object. Suppose you have an atom with an electron in its outer shell, about to leave the atom and be taken up into another, rendering the atom an ion with a positive charge. At the moment, the atom has no charge – it is neutral. But as soon as the electron has completely left the atom, the atom will have a positive charge. It will thus have a new trope – a charge trope – that it did not previously have, and which did not previously exist, since tropes are non-repeatable. But it may well be a vague matter as to when the electron has completely left the atom's shell, as to when the atom can fully and officially be said to have charge. At the points in time (brief as they are) when the electron is in such a state, it will be indeterminate whether the atom has a charge. And as such, it will likewise be indeterminate whether the atom has a charge trope – indeterminate whether *there*

[6] I.e. tropes that represent a change in mass compared to the previous trope.

[7] It seems at least possible, for example, that time might be 'gunky' in a way analogous to the picture of matter given by theories of 'atomless gunk'.

is a charge trope for that particular atom. As with the Einsteinium case for Universals, there's conceptual room to deny that such a scenario is sufficient for vague existence, but it's certainly skirting rather close.

3. Conclusion

It seems, then, that adopting a sparse property ontology by no means avoids worries of ontic vagueness. Though they may dispense with classically vague properties like redness and baldness, trope-theory and Universals-theory still encounter 'borderline region' puzzles similar to those so familiar in the properties they eschewed. Unless a convincing rebuttal to such charges of ontic vagueness can be found, then a stark revision is needed in ontology: either accept the existence of ontic vagueness or side with the nominalist and give up on property ontology altogether.[8]

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