SUPERSUBSTANTIVALISM AND VAGUE LOCATION

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Abstract. One well-known objection to supersubstantivalism is that it is inconsistent with the contingency of location. This paper presents a new objection to supersubstantivalism: it is inconsistent with the vagueness of location. Though contingency and vagueness are formally similar, there are important philosophical differences between the two. As a result, the objection from vague location will be structurally different than the objection from contingent location. The paper explores these differences and then defends the argument that supersubstantivalism is inconsistent with the plausible thesis that it is vague where I am located.

Supersubstantivalism is the view that material objects are regions of spacetime − material objects are identical to their spacetime locations.[1] One well-known objection to the view is the so-called argument from contingent location. I am located at a particular region of spacetime. This region − my *location* − has the exact same size and shape as I do.[2] However, it is *contingent* where I am located. I could have been located somewhere else. Given some plausible background principles governing metaphysical modality, this is inconsistent with supersubstantivalism.[3]

But it is not only contingent where I am located − it is also *vague* where I am located. I take it that I do not have a perfectly precise shape. Though there are a number of very similar body shaped regions in my vicinity, it's vague which of them I have the same shape as. Thus,

[1]For defenses, see Sider (2001), Skow (2005), Schaffer (2009), Nolan (2014), and Eagle (2016).

[2]By *location* I mean *exact location* (which is sometimes also called the region that I *occupy*). In addition to having my exact size and shape, my exact location also bears the same distance relations to things that I do. See Casati and Varzi (1999), Parsons (2007) and Gilmore (2018).

[3]This quick argument will be developed with more care in due course.

there's no region that I am definitely located at. It is vague where I am located.

The primary purpose of this paper is to argue that supersubstantivalism is not only inconsistent with the contingency of where I am located, but that it is also inconsistent with the vagueness of where I am located.

It is no news that supersubstantivalism is in tension with the thesis of contingent location.[4] Given the formal similarities between contingency and vagueness (both can be defined in the same way with a necessity or definiteness modal operator), one might be tempted to think that the tension straightforwardly carries over to the thesis of vague location. But this is mistaken. Even though contingency and vagueness are formally similar, there are important philosophical differences between the two. What these differences reveal is that the argument from contingent location relies on principles that are compelling for the case of metaphysical modality, but implausible for the logic of vagueness. Moreover, the argument I will defend from vague location relies on a plausible assumption about definiteness which is not plausible for necessity. Thus, the novel argument I will defend will be structurally quite different than the more familiar argument from contingent location.

The plan for the paper is as follows. In the second section, I will present a natural version of the argument from contingent location. I will then highlight the first difference between contingency and vagueness and show how this leaves us without an analogous argument from vague location. In the third section, I will defend the new argument from vague location. But first, I begin with some preliminaries.

1. Preliminaries

Supersubstantivalism and The Identity Theory. Supersubstantivalists maintain that material objects are regions of spacetime. Being located at a region, for the supersubstantivalist, is the same thing as being identical to that region. In this paper, I will formulate supersubstantivalism with the resources of higher-order logic and the arguments I develop will be developed in this setting. Though supersubstantivalists have not typically formulated their view in this way, I think that they should. Failing to do so undermines one of the strongest

[4]Supersubstantivalists have responded by appealing to counterpart theory, here: Sider (2001), Skow (2005), and Schaffer (2009).

arguments for the view. At the end of this subsection, I will show how. But first, let me give some details for how I will be thinking about the view.

I take supersubstantivalism to be proposing a metaphysical analysis of location, an analysis I will call the *identity theory of location*. There are, in fact, a number of natural ways of formulating the analysis. I will briefly sketch three. First, according to what I will call the *simple identity theory*, what it is for x to be located at y is for x to be identical to y. In the paper, I will follow the framework laid out in Dorr (2016) and Rayo (2015), and I will write '$\varphi \equiv \psi$' to express the higher-order identification that for it to be the case that φ is for it to be the case that ψ. We can formulate the simple theory as:

$$(x \text{ is located at } y) \equiv (x = y) \qquad \text{(Simple-Identity)}$$

This says that to be located is to be identical.[5]

However, there are some immediate problems with this analysis which suggest a couple of amendments. First, the simple theory implies that *everything* is located at itself: for instance, the number seven! But like the number seven, there seem to be plenty of things not located anywhere at all. This suggests a second analysis, where for x to be located at y is for y to be a *region* such that x is identical to y:

$$(x \text{ is located at } y) \equiv (y \text{ is a region and } x = y) \qquad \text{(R-Identity)}$$

This says that to be located is to be identical to a region. That is, being a region is part of what it is to being something's location.

An alternative amendment to the simple theory is natural for those who accept (i) a restricted version of supersubstantivalism according to which only some (but not all) regions count as material objects,

[5]Or with the Rayo gloss: being located *just is* being identical. Officially, Dorr would formulate the thesis as: x is located at $y \equiv_{x,y} x$ is identical to y, where the subscripts indicate that x and y are both bound by '$\equiv$'. For simplicity of notation, I will not include the subscripts throughout the paper, but will leave them implicit. I am not just taking these identities to hold case by case; rather, I take this to say that the relations are identical. Moreover, I've formulated the theory in what Dorr calls the sentential style. But we can also formulate (Simple-Identity) in the predicative style as follows: $\lambda(x, y)(x \text{ is located at } y) \equiv \lambda(x, y)(x \text{ is identical to } y)$. Or more briefly, location *is* identity.

and (*ii*) the thesis that location is only a relation between *material objects* and *regions*. Some supersubstantivalists − Schaffer (2009), for instance − not only claim that all material objects are regions, but also that all regions are material objects.[6] But others − Nolan (2014), for instance − deny this and claim that only some regions of spacetime count as material objects.[7] The problem is that (*i*) and (*ii*) are inconsistent with both (Simple-Identity) and (R-Identity), since both (Simple-Identity) and (R-Identity) imply that every region has a location, and thus (if only material objects have locations) then every region is a material object. But restricted supersubstantivalism is consistent with another natural analysis of location:

$$(x \text{ is located at } y) \equiv (x \text{ is a material object and } x = y) \qquad \text{(M-Identity)}$$

This says that to be located at something is to be a material object identical to that thing. Assuming that material objects are regions, this theory of location says that to be located is to be a material object that is identical to a region. That is, being a material object is part of what it is to being located.

As we've just seen, the supersubstantivalist has a number of candidate analyses available to adopt. As we press on, when I refer to the identity theory without qualification, I will be referring to the disjunction of these three theories (keeping in mind that (R-Identity) and (M-Identity) are the more plausible of the three).

As mentioned above, though supersubstantivalists have not typically formulated their view as an identification, failing to do so undermines a powerful argument for supersubstantivalism − the argument from geometrical and mereological harmony, from Skow (2007) and Schaffer (2009). According to this argument, the supersubstantivalist (unlike their dualist rival) can explain why it is that necessarily, my body and

[6]One natural question for those supersubstantivalists who also think that all regions of spacetime are material objects is whether this is necessarily the case. If so, one natural way of stating the view would be as a metaphysical analysis: $Mx \equiv Ry$, which says that for x to be a material object is for x to be a spacetime region (and equivalently, given that '$\equiv$' is symmetric, to be a region is to be a material object). See Dorr (2016), pg. 43.

[7]Which regions count as material objects? Nolan discusses a number of possible answers to this question. See pg. 95.

its location have the same size and shape. And she can explain why it is that necessarily, if my arm is a part of my body, then my arm's location is a part of my body's location. That is, she can explain the following necessary truths:

> Necessarily, if x is located at y, then x is the same size and shape as y. (G-Harmony)

> Necessarily, if x is located at y, w is located at z, and x is a part of w, then y is a part of z. (P-Harmony)

But to explain these platitudes, the supersubstantivalist must rely on a higher-order claim about location. Suppose instead that the view is formulated as a mere necessary biconditional, perhaps something like the following:

> Necessarily, x is located at y iff y is a region and $x = y$ (*)

Though the supersubstantivalist does have a valid argument for both (G-Harmony) and (P-Harmony) with (*) as a premise, she doesn't really have a *satisfying* explanation for these truths.[8] The argument relies on (*), which is itself an alleged necessary truth: but why is *it* true? The explanation of (G-Harmony) and (P-Harmony) is merely pushed back a step. But with an identification, like (R-Identity) for instance, there is no problem. (R-Identity) implies (*), and so implies (G-Harmony) and (P-Harmony), given Leibniz's Law. But (R-Identity) is itself an identification, and identifications are excellent stopping places for explanation. The supersubstantivalist does, in fact, have a powerful argument for harmony, but only if she adopts the identity theory of location.[9] The argument I defend in this paper is aimed at the identity theory, but this is not merely a Straw Man. The supersubstantivalist needs the identity theory in order for the argument from harmony to be convincing. To be fair, there are versions of supersubstantivalism that are not subject to the worries raised in

[8]Here is the argument. Consider (G-Harmony). If I am located at R, then I am identical to R, by (SS). And by Leibniz's Law, R and I have the same properties (including geometrical properties). So (G-Harmony) is true. Parallel reasoning shows that (P-Harmony) is true.

[9]See [blinded] for more details.

this paper. For instance, Arntzenius (2012; pgs. 181-182) sets forth an eliminativist version of supersubstantivalism, according to which spacetime exists, but material objects do not. While the argument I develop poses no problem for this version of eliminativism about material objects, it's not obvious that this version can help itself to the argument from harmony described above.

Modality and Vagueness. When it comes to issues concerning modality, I will introduce an operator for necessity '$\Box\varphi$' which means 'it is necessary that φ'. We can then define possibility in the usual way – for it to be possible that φ is for it to not be necessary that not-φ. I will assume some fairly standard and uncontroversial axiom schemas governing necessity. I will assume that it obeys the modal logic T, and thus that it obeys the following two schemas:

$$\Box\varphi \rightarrow \varphi \tag{$\mathrm{T}_\Box$}$$
$$\Box(\varphi \rightarrow \psi) \rightarrow (\Box\varphi \rightarrow \Box\psi) \tag{$\mathrm{K}_\Box$}$$

I am going to treat issues concerning vagueness very much like I treat issues concerning modality.[10] Before I describe the formal way I treat vagueness, I should mention that it is sometimes thought that the phenomenon of vagueness shows that we should reject classical laws of logic like bivalence and excluded middle. But I think that this is mistaken. I will assume classical logic.[11]

My formal treatment of vagueness will employ a pair of sentential operators, where '$\Delta\varphi$' means 'it is *definite* that φ', and where '$\nabla\varphi$' means 'it is *vague* whether φ' (I will use 'vague' and 'borderline' interchangeably). And I will assume that we can sensibly quantify into these operators. As usual, we can take either operator and define the other in terms of it: for it to be *vague* whether φ is for it to be neither

[10]My way of setting up issues concerning vagueness follows the setup in [redacted].

[11]Obviously, this is not the place to defend this point in any detail. However, see Williamson (1994), pgs 187-198, for an argument for why the temptation to reject classical logic for vagueness related reasons is mistaken. Moreover, see Bacon (2018), Chapter 1, for some additional problems with weakening classical logic for vagueness related reasons. Also note that supervaluationists standardly accept the directly relevant principles of classical propositional logic, like the law of excluded middle, as do the ontic views in Barnes and Williams (2009) and Wilson (2017).

definite that φ, nor definite that not-φ; and for it to be *definite* that φ is for it to be the case that φ, but not vague whether φ.[12]

As with necessity, I will assume that definiteness obeys the modal logic T:

$$\Delta\varphi \to \varphi \qquad (\mathrm{T}_\Delta)$$
$$\Delta(\varphi \to \psi) \to (\Delta\varphi \to \Delta\psi) \qquad (\mathrm{K}_\Delta)$$

Moreover, I will assume that (T_Δ) and (K_Δ) are both definitely, definitely, ..., definitely true.[13]

More controversially, I will assume the legitimacy of substitutional Leibniz's Law:

$$a = b \to \varphi[a/x] \to \varphi[b/x]$$

where $\varphi[a/x]$ is the formula which is just like φ except that a is substituted for free occurrences of x in φ. Famously, substitutional Leibniz's Law implies the necessity of identity.[14] One instance of substitutional Leibniz's Law is:

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[12]Though it doesn't matter for our purposes which we take as primitive, I will assume that the following linking-biconditionals definitely hold:

$$\nabla\varphi \;\leftrightarrow\; (\neg\Delta\varphi \wedge \neg\Delta\neg\varphi)$$
$$\Delta\varphi \;\leftrightarrow\; (\varphi \wedge \neg\nabla\varphi)$$

[13]Why think that (K_Δ) is true? Here is a little argument on its behalf. Suppose that it is false; specifically, the following instance: If it's definitely the case that if it rains, then I get wet, then if it definitely rains, then I definitely get wet – or, $\Delta(P \to Q) \to (\Delta P \to \Delta Q)$. Suppose that is false. In other words, it's definitely the case that if it rains, then I get wet ($\Delta(P \to Q)$), and yet it's not the case that if it definitely rains, then I definitely get wet ($\sim(\Delta P \to \Delta Q)$). That's equivalent to saying that it definitely rains (ΔP) but it's not definite that I get wet ($\sim\Delta Q$). But if it's not definite that I get wet, then I *may* not get wet. Here's why. Say that it *may* φ just in case it's not definite that not φ (or, in symbols, $\diamond\varphi =_{df} \sim\Delta\sim\varphi$). To say that it's not definite that I get wet is equivalent to saying that I may not get wet (that is, '$\sim\Delta Q$' is equivalent to '$\diamond\sim Q$'). But that can't be right. We started by assuming that it was definite that if it rains, I get wet. But if that's true, and it definitely rains, it must be true that I definitely get wet, as well.

[14]See Marcus (1947) and Kripke (1971).

$$a = b \rightarrow \Box(a = a) \rightarrow \Box(a = b)$$

Since we know that $\Box(a = a)$,[15] it follows that $a = b \rightarrow \Box(a = b)$.

Similarly, substitutional Leibniz's Law implies the definiteness of identity.[16] An analogous instance of it is:

$$a = b \rightarrow \Delta(a = a) \rightarrow \Delta(a = b)$$

But since we know that $\Delta(a = a)$,[17] it follows that $a = b \rightarrow \Delta(a = b)$.[18]

Before moving on, it is worth pausing up front to note why some might reject substitutional Leibniz's Law. A number of philosophers have defended certain versions of counterpart theory. Indeed, some have relied on counterpart theory to defend contingent identity. And some supersubstantivalists have relied on counterpart theory in response to the argument from contingent location.[19] Substitutional Leibniz's Law (in a modal language) rules out these ideas. Though this paper is not the place to develop a full defense of substitutional Leibniz's Law, I should at least mention in passing that it is jointly implied by two principles that I find to be plausible: (1) a weak version of Leibniz's Law, $(a = b \rightarrow Fa \rightarrow Fb)$, and (2) the principle of β-conversion:

[15]One can either take this as an assumption (which is what I officially will do), or one can add the Rule of Necessitation as an additional assumption, and then derive $\Box(a = a)$ from $a = a$ and Necessitation.

[16]See Evans (1978) and Salmon (1982) for related arguments.

[17]Again, I'll take this as an assumption. But one can also derive it from Necessitation and from '$a = a$'. Necessitation says that if φ is a theorem, then so is $\Delta\varphi$. Since '$a = a$' is a theorem, we can infer that definitely $a = a$.

[18]Evans (1978) gave a much-discussed proof of a related conclusion: $\nabla(a = b) \rightarrow a \neq b$. In other words, if it is vague whether a is identical to b, then a is distinct from b. However, his argument showed less than he thought. Evans seems to think that he provides a *reductio* on the assumption that $\nabla(a = b)$, thereby showing that it can never be vague whether a is identical to b. However, he never actually derives a contradiction (without S5, that is, which is totally implausible for Δ, a point which is made in Heck (1998) and McGee (1997)), and thus fails to show that there can never be cases of borderline identity. He did, however, correctly show something interesting: *borderline identity implies distinctness.*

[19]See Sider (2001), Skow (2005), and Schaffer (2009) for the standard counterpart theoretic reply to the objection that the identity theory is inconsistent with contingent location.

$(\lambda x.\varphi)a \leftrightarrow \varphi[a/x]$.[20] I, therefore, will assume substitutional Leibniz's Law.

Moreover, one might take '$\nabla\varphi$' to be mere shorthand for a metalinguistic claim like 'the sentence $\ulcorner\varphi\urcorner$ is indeterminate'.[21] And so one might deny the legitimacy of quantifying into vague contexts. However, it is worth mentioning that historically, some philosophers also thought that quantifying into modal contexts was illegitimate. Such philosophers thought that claims like 'necessarily, $a = b$' were implicitly quotational, and that modality was purely metalinguistic.[22] I, however, will assume that we can quantify into both modal and vague contexts.

The purpose of this paper, of course, is not to convince the reader that counterpart theory is false or that metalinguistic approaches to vagueness are false. The paper can be read conditionally: if, like me, one adopts substitutional Leibniz's Law, if one takes modality seriously, and one treats vagueness like modality in certain plausible ways, then we'll see that the identity theory is false.[23]

2. The Argument from Contingent Location

In this section, I will develop an argument to show that the identity theory is inconsistent with the plausible thesis that it is contingent where I am located. The version of the argument I will defend relies on a higher-order version of Leibniz's Law (as does the argument from vague location I defend in the next section). This principle states that

[20]Note that some supervaluationists reject β-conversion for precisely this reason: see Thomason (1982), Lewis (1988), McGee (1997). I will discuss this further when considering objections to the argument from vague location I develop in section 3.

[21]See, for instance, McGee (1997), pg. 152, who writes "Just to make sense of the attachment of the word 'determinately' to an open sentence containing free variables is a bit of a stretch, since we primarily think of determinacy as an attribute of sentences."

[22]See, for instance, Quine (1953).

[23]Though some further problems for metalinguistic approaches to vagueness are worth mentioning. First, there are well-known issues concerning higher-order vagueness discussed in Williamson (1994). Second, many take Montague's Theorem to show a problem with metalinguistic approaches to modality. But as Bacon (2018) notes, the same problem arises for metalinguistic approaches to vagueness which take vague expressions to be implicitly quotational, so long as Δ obeys the modal principles K and T. Also see Bacon (2018; chapter 2) for additional problems with supervaluationist approaches to vagueness.

given a higher-order identification, the terms flanking '$\equiv$' are intersubstitutable:

$$\varphi \equiv \psi \ \rightarrow \ \chi[\varphi/p] \rightarrow \chi[\psi/p]$$

where $\chi[\varphi/p]$ is a sentence which is just like χ except that φ is substituted for free occurrences of the propositional variable p in χ.[24]

The argument begins with what I take to be an incredibly plausible judgment: it is contingent where I am located. The claim that it is contingent where I am located has a number of possible readings. But the one I will highlight is the following: *if I am located at R, I could have possibly been located somewhere else*. It's not a metaphysically necessary fact that I be located where I am in fact located. I could have been located elsewhere: there are a number of regions distinct from my location at which I could have been located.

Suppose that I am located at R. The argument runs as follows:

> (1_c) There is a region R' distinct from R such that it is possible that I be located at R'.
> (2_c) But if the identity theory is true, then no region R' distinct from R is such that it is possible that I be located at R'.
> (3_c) Therefore, the identity theory is false.

Why is (2_c) true? Before sketching the argument, it is worth making an important note. We should not confuse the necessity and definiteness of *identity* with the necessity and definiteness of *distinctness*:

$$a \neq b \rightarrow \Box(a \neq b) \qquad \text{(Necessity of Distinctness)}$$
$$a \neq b \rightarrow \Delta(a \neq b) \qquad \text{(Definiteness of Distinctness)}$$

Though the necessity and definiteness of *identity* follow from substitutional Leibniz's Law, there is no similarly straightforward argument from substitutional Leibniz's Law for the necessity and definiteness of *distinctness*. However, they do in fact follow from substitutional Leibniz's Law together with the B axiom schema. B is a very plausible

[24]See Dorr (2016), pgs. 48-49, for a couple of different versions of this principle. And see pgs. 50-51 for a discussion of how these principles relate to the issue of opaque contexts, generated for instance by attitude ascription reports, such as "Lois believes Superman can fly."

schema for the logic of metaphysical necessity:

If not-p, then it's necessarily not necessary that p. ($\mathsf{B}_\Box$)

Or, equivalently: if p, then it's necessarily possible that p. ($\mathsf{B}_\Box$) is widely accepted. As Williamson (2013) notes, "If something is so, then how could it have been metaphysically impossible?" (p. 44).[25]

Now for the argument. (2_c) follows from higher-order Leibniz's Law and the necessity of distinctness. Since I am located at R, the identity theory and higher-order Leibniz's Law jointly imply that I am identical to R. But for any distinct region R', I am necessarily distinct from R', by the necessity of distinctness. That is, no distinct R' is such that I am possibly identical to R'. But since according to the identity theory, being identical to R' is part of what it is to be located at R', it is not possible to be located at R'. Therefore, if the identity theory is true, then no region R' distinct from R is such that it is possible that I be located at R'. Thus, given the truth of (1_c), it follows that the identity theory is false.

This leads us to the first important difference between necessity and definiteness:

> **Necessary Distinctness, but not Definite Distinctness:** If $x \neq y$, it follows that necessarily $x \neq y$. But if $x \neq y$, it does not follow that it is definite that $x \neq y$.

Though ($\mathsf{B}_\Box$) is plausible and very widely accepted (and thus, so is the necessity of distinctness), the corresponding schema for definiteness is not plausible:

If not-p, then it's definitely not definite that p. (B_Δ)

Consider a sorites series of shades of color from red to orange. And now consider a particular shade s in the series which is not red, but which is a borderline case of being red. We know that s is not definitely red, otherwise, by (T_Δ), s would be red. (B_Δ) tells us that since s is not red, it is *definite* that s is not definitely red. But why think that?

[25]See, however, Garson (2014) for some hesitation regarding (B). Also see Bacon (forthcoming).

It seems as if it could be *vague* whether s is not definitely red. The problem with (B_Δ) is that it rules out higher-order vagueness, which seems implausible. Not only can it be vague whether a particular shade is red, but it can be vague whether it's vague whether it is red.[26]

This highlights an interesting dialectical point. As I mentioned in the Introduction, one might have thought that developing a strong version of the argument from contingent location would automatically generate an analogously strong argument from vague location. But this is false. Say that *it may be that* φ just in case it's not definitely not-φ ('it may be that φ' is formally analogous to 'it is possible that φ'). Consider the argument which runs parallel to the argument from contingent location defended above. Assume that I am located at R:

> (1_v) There is a region R' distinct from R such that I may be located at R'.
> (2_v) But if the identity theory is true, then no region R' distinct from R is such that I may be located at R'.
> (3_v) Therefore, the identity theory is false.

Premise (1_v) is plausible: there are a number of regions that I am not definitely not located at. However, we have no reason to buy (2_v). Without (B_Δ), we are not assured of the definiteness of distinctness. If I am located at R, the identity theory implies that I am identical to R. So I am not identical to (and thus not located at) a distinct region R'. But it doesn't immediately follow that I am definitely distinct from R', and thus it doesn't immediately follow that I am definitely not located at R'. Though necessity and definiteness share a number of formal similarities, they are philosophically quite different. Therefore, our argument from vague location against the identity theory will need to be a structurally different argument.[27]

[26]A related point is made in Williamson (1994) and McGee (1997). Also, see Bacon (ms a), who argues that the B principle is what accounts for many of the paradoxes of higher-order vagueness, and thus should be rejected.

[27]Of course, if one does accept (B_Δ), then this argument would go through. But for those of us who find higher-order vagueness plausible, we will have to look elsewhere.

3. The Argument from Vague Location

The argument I will defend is as follows.

> (4_v) Definitely, I am located somewhere.
> (5_v) For any region R, if I am located at R, then it is vague whether I am located at R.
> (6_v) If (4_v), and the identity theory is true, then for any region R, if I am located at R, then it is not vague whether I am located at R.
> (7_v) Therefore, the identity theory is false.

Premises (4_v) and (5_v) are both plausible. Premise (4_v) says that definitely, there is some R such that I am located at R. But, even though it is definite that there is some R such that I am located at R, no R is such that I am definitely located at *it*. Of course, I am not saying that I don't have a location. I am located at some region, even though I can't pick it out precisely. But whichever region I am located at, that region is merely a borderline case of being my location. That is, there is no region which I am *definitely* located at. And so premise (5_v) is plausible.

Now for (6_v). It is straightforward to see that if (4_v) is true and (Simple-Identity) is true, then for any region R, if I am located at R, then it is not vague whether I am located at R. For any region R, if I am located at R, then by the simple theory and higher-order Leibniz's Law, I am identical to R. By the definiteness of identity, I am definitely identical to R. And by one more application of higher-order Leibniz's Law, I am definitely located at R. Thus, it is not vague whether I am located at R.

But again, (Simple-Identity) is not very plausible. Let's turn to the more promising formulations of the identity theory: (R-Identity) and (M-Identity). Let's start with (R-Identity), which, to remind the reader, says that to be located is to be identical to a region. It will be helpful to first prove a lemma:

> If definitely, I am located somewhere, and (R-Identity) is true, then I am definitely a region. (Lemma 1)

If definitely, there is some R that I am located at, then by higher-order Leibniz's Law and (R-Identity), definitely, there is some R that is a region and that I am identical to. From this it follows that I am definitely a region, since $\Delta(\varphi \wedge \psi)$ implies both $\Delta\varphi$ and $\Delta\psi$.

I will now show that if (4_v) is true and (R-Identity) is true, then for any region R, if I am located at R, then it is not vague whether I am located at R. Suppose I am located at R. By higher-order Leibniz's Law, it follows that R is a region and I am identical to R. By (Lemma 1) and the definiteness of identity, it follows that definitely R is a region and definitely I am identical to R. From this it follows that definitely, R is a region and I am identical to R (because $\Delta\varphi$ and $\Delta\psi$ jointly imply $\Delta(\varphi \wedge \psi)$). And by higher-order Leibniz's Law and (R-Identity), it follows that definitely, I am located at R. Therefore, it is not vague whether I am located at R.

Parallel reasoning shows that if (4_v) is true and (M-Identity) is true, then for any region R, if I am located at R, then it is not vague whether I am located at R. As before, this argument relies on an analogous lemma:

> If definitely, I am located somewhere, and (M-Identity) is true, then I am definitely a material object. (Lemma 2)

If definitely, there is some R that I am located at, then by higher-order Leibniz's Law and (M-Identity), definitely, there is some R such that I am a material object and identical to R. From this it follows that I am definitely a material object.

Suppose I am located at R. By higher-order Leibniz's Law, it follows that I am a material object and am identical to R. By (Lemma 2) and the definiteness of identity, it follows that definitely I am a material object and definitely I am identical to R. From this it follows that definitely, I am a material object and am identical to R. And by higher-order Leibniz's Law and (M-Identity), it follows that definitely, I am located at R. Therefore, it is not vague whether I am located at R.

So if either (Simple-Identity), (R-Identity) or (M-Identity) are true, and definitely I am located somewhere, then for any R, if I

am located at R, it is not vague whether I am located at R. So (6_v) is true. And from (4_v)–(6_v), it follows that the identity theory is false.[28]

It is worth pausing to consider some objections. First, one might be worried about arguments containing vague names (or in the above argument, the indexical "I"). A certain type of supervaluationist claims that (β-conversion) is only valid when the names (and presumably, indexicals, as well) are not vague and so will reject substitutional Leibniz's Law when vague names are present.[29] I have two responses. First, as mentioned in the preliminary section, I am assuming that vagueness is to be treated like modality. The exactly analogous issue arises in the modal context. If one thought that names were not modally rigid (which was the standard pre-Kripkean view), then one might likewise reject (β-conversion) and substitutional Leibniz's Law when names were present. This, I think, is mistaken in the modal context. And for this reason, I think it is mistaken in the vagueness context, as well.

Second, and more importantly, we can just rewrite (4_v)-(7_v) with variables, rather than names or indexicals, by Existential Generalization (EG). That is, by (EG), (4_v) becomes: Definitely, there is an x such that x is located somewhere. And so on. The objection to vague names and indexicals does not apply.[30]

A second objection might be to reject the premise (5_v). One might still try to salvage some other claims in the vicinity: for example, one might explore the alternative view that it is vague what my parts are and, thus, vague in a sense what my boundary is. But this is just to deny the highly plausible judgment with which we began the paper: no region is such that I am definitely located there. However, this response does raise an interesting issue. It is not immediately clear how the thesis that I am definitely located somewhere interacts with

[28]A fiddly issue arises: might the identity theory be only *vaguely* true? If I am located at R, and it is vague whether the identity theory is true, then it would be vague whether I am located at R. So one might think that the identity theory is consistent with it being vague whether I am located at R after all. But this would also show that the identity theory is false. By paralleling the argument for the definiteness of identity, we can use higher-order Leibniz's Law to show that the identity theory implies the definiteness of the identity theory (and thus the vagueness of the identity theory implies the falseness of the identity theory).

[29]See Thomason (1982), Lewis (1988), and McGee (1997).

[30]One supervaluationist rejects Existential Generalization when vague names are present; see McGee (1997). For what it's worth, rejecting (EG) seems to be a very high a price to pay.

the mereological thesis that it's vague what my parts are. In general, it's not clear at all how parthood and location interact once vagueness is introduced.[31]

This brings us to a second difference between definiteness and necessity:

> **Definite Location, but not Necessary Location:** Though I am definitely located somewhere, it's not the case that I am necessarily located somewhere.

To see this, note that either contingentism is true or necessitism is true. The contingentist thinks that it is contingent whether I exist. There are possible worlds where I do not exist, and in those worlds I am not located. Therefore, it is not necessary that I am located somewhere. The necessitist, on the other hand, thinks that necessarily, everything is necessarily something. But even she should think that it's not the case that I am necessarily located.[32] This is because even though I exist in all possible worlds, there are worlds where I exist but am not concrete. And if I am not concrete in a world, then, presumably, I am not located in that world − as Williamson (2013: pg. 13) says: "Where is the merely possible coin actually? Nowhere." So if either contingentism or necessitism is true, it is not necessary that I am located.

This is enough to show that the following argument − which is analogous to the argument from vague location defended above − is unsound:

> (4_c) Necessarily, I am located somewhere.
> (5_c) For any region R, if I am located at R, then it is contingent whether I am located at R.

[31]Unfortunately, this paper is not the place to explore these interesting issues. However, here is one relevant observation. I've been talking about my *exact* location, but other authors discuss other locative relations. It's interesting to note that even if we assume that I have a definite exact location, very little follows about the definiteness of other locative relations (defined mereologically) I bear to regions. For instance, following Parsons (2007), say that x *pervades* y just in case there is some region R such that x is located at R and y is a part of R. Even if I am definitely located at R, it doesn't follow that I definitely pervade every part of R (in particular, I do not definitely pervade the particle shaped region y on the outskirts of my body where is it vague whether y is part of R).

[32]For defenses of necessitism, see Williamson (2013) and Goodman (2016).

(6_c) If (4_c), and the identity theory is true, then for any region R, if I am located at R, then it is not contingent whether I am located at R.
(7_c) Therefore, the identity theory is false.

This argument is unsound because (4_c) is clearly false.

The version of the argument from contingent location I defended in the previous section highlighted the fact that the identity theory is inconsistent with the judgment that I could have been located somewhere other than where I am located. It might also be tempting to think that the identity theory is inconsistent with the claim that *if I am located at R, then I am contingently located at R*. And so it might be tempting to think that if the identity theory is true, then if I am located at R, then it's *not the case* that I am contingently located at R (and thus that the identity theory is false). While this style of argument works against (Simple-Identity), it does not work against (R-Identity) and (M-Identity), which are both consistent with it being the case that if I am located at R, then I am contingently located at R.

To see this, note that (M-Identity) is consistent with it being contingent whether I am a material object. And if (M-Identity) is consistent with it being contingent whether I am a material object, then (M-Identity) is consistent with it being contingent whether I am located at R, since being located at R just is being a material object that is identical to R. Similarly, (R-Identity) is consistent with it being contingent whether I am a region. In fact, if the identity theory is true, there are reasons to think that it is contingent whether I am a region. It is plausible to think that for every particular region of spacetime, it is contingent whether that region is a region. Not only is it plausible to think that spacetime itself might have not existed, but general relativity suggests that the structure of spacetime could have been different (in which case, the regions that actually exist might not have existed). Since (R-Identity) is consistent with it being contingent whether I am a region, (R-Identity) is consistent with it being contingent whether I am located at R, since being located just is being identical to a region.

A related observation can be made about the identity theory and vague location. We've just seen that (M-Identity) and (R-Identity) do not imply that if I am located at R, I am not contingently located at R. This is because (M-Identity) and (R-Identity) are both

consistent with it being contingent whether I am a material object and contingent whether I am a region. Analogously, (M-Identity) and (R-Identity) do not imply that if something is located at R, then it is not vague whether it is located R. This is because (M-Identity) and (R-Identity) are consistent with there being borderline material objects and borderline regions.

Could there be borderline material objects, or borderline regions? I don't know. But here are a couple of examples that are worthy of consideration. First, suppose that a restricted version of supersubstantivalism is true, and that only some regions count as material objects. And suppose that what it is for a region to be a material object is for the region to instantiate some property (say, having a non-zero value of mass). If it could be vague whether a region has a non-zero value of mass, then it could be vague whether that region is a material object.[33] Second, consider a sorites series of worlds, where one end (say, the actual world) contains the Eiffel Tower. Throughout the series, the particles composing the Eiffel Tower continuously move further and further away from one another until, at the end of the series, there is a possible world where the particles composing the Eiffel Tower (in the actual world) are dispersed throughout the universe (and thus, the Eiffel Tower does not exist). A number of worlds in the series will be worlds where it is vague whether the Eiffel Tower is a material object (and also vague whether it is a region, for the supersubstantivalist) because it will be vague whether or not there is an Eiffel Tower in those worlds at all. This doesn't just show that there is reason to think that there are borderline material objects. If the Eiffel Tower is a region, then this modal sorites shows that there can be borderline regions. All of this is compatible with both contingentism and necessitism. If contingentism is true, then the modal sorites above implies that there can be vague existence.[34] But if necessitism is true, no such thing is implied. For the necessitist, though the Eiffel Tower exists in all worlds,

[33]Nolan (2014) takes something like this very seriously. He then argues that since being a part of something *just is* being a material object that is a subregion of another material object, since it can be vague whether some region is a material object, it could be vague whether that region is a part of something.

[34]Vague existence is a controversial topic. See Lewis (1986: p. 213), Hawley (2002), Sider (2003), and Carmichael (2011).

there are a number of worlds in the series where it is vague whether the Eiffel Tower is concrete.[35]

So it is important not to overstate the problem for the identity theory: the identity theory is not inconsistent with the thesis that *some material object is such that it is vague where it is located*, because if there could be borderline material objects and borderline regions, then it would be vague where they are located.[36] But the identity theory is, however, inconsistent with the plausible thesis that it is vague where I am located, given that I definitely have a location (and any other thing that definitely has some location). And this is sufficient, I am inclined to think, to show that it is false.

4. Conclusion

I could have been located somewhere other than where I am in fact located − it's contingent where I'm located. Moreover, even though I am definitely located somewhere, no region is such that I am definitely located there − it's vague where I am located. For those of us who adopt these platitudes, as well as the series of plausible background principles set out in the beginning of the paper, this is enough to show that supersubstantivalism is false.[37]

[35]Here is one more (albeit exotic) example. Suppose that p is a subatomic particle having no proper parts, and suppose there is an object A such that it is vague whether p is a part of A. Also suppose that it is vague whether the number seven is a part of A, and that A has no other definite proper parts or vague proper parts. If supersubstantivalism is true, then it seems to be vague whether A is a region.

[36]Interestingly, we can show that if the simple theory is true, then even if it could be vague where some object is located, we could never know it or never assert it. Bacon (2018) argues that the following result is derivable from the modal logic T: vague identity implies vague identity at every order. As Bacon notes, if vagueness precludes knowledge and forbids assertion, if it is vague whether $x = y$, then we can never know it and can never assert it. But given (Simple-Identity) and higher-order Leibniz's Law, we can substitute and show that vague location implies vague location at every order. So if there is an object such that it is vague where it is located, the simple theory implies that one can never know it and can never assert it.

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