**What is an extended simple region?**

**Introduction**

The notion of an extended simple region (henceforth ESR) has recently been marshalled in the service of arguments for a variety of conclusions. Exactly how to understand the idea of extendedness as it applies to simple regions, however, has been largely ignored, or, perhaps better, assumed. In this paper we first (§1) outline what we take to be the standard way that philosophers are thinking about extendedness, namely as an intrinsic property of regions. We then introduce an alternative picture (§2), according to which extendedness is extrinsic. In §3 we argue that it matters which way of thinking about extendedness is the right one, since how ESRs behave is sensitive to what extendedness consists in, and various arguments that appeal to ESRs turn out to be unsound if extendedness is extrinsic rather than intrinsic.

1. **The standard view of extendedness**

In some good sense we all agree what it would be to be an extended simple region. A region is an ESR iff it is *extended* (it has non-zero spatiotemporal extent; it is not point-sized) and it has no proper sub-regions and hence is *simple*. In what follows we assume that proper sub-regions are proper parts of regions, so that ‘simple’ in this context means *mereologically simple*.[[1]](#footnote-2)

Nevertheless, that characterisation leaves open the question of what it *is* to lack proper parts, and what it *is* to have extendedness. In what follows we target the second of these questions with a focus on answers that allow for the possibility of ESRs, and argue that one way of answering the question has been overlooked. That oversight is important. An understanding of space-time[[2]](#footnote-3) requires an account of what it is for a region to be extended, and, as a corollary, whether ESRs are possible. Moreover, we want to know not only about space-time regions themselves, but also about the relations objects can bear to those regions. That requires determining whether ESRs are possible, and, if they are, what relations obtain between extended objects (simple[[3]](#footnote-4) and composite) and extended space-time regions (simple and composite). This latter question is particularly pressing (and instructive) in the context in which one is a substantivalist about space-time,[[4]](#footnote-5) holding that space-time regions are distinct from material objects, with the latter bearing various location relations to the former.[[5]](#footnote-6) For if how we characterise ESRs has implications for understanding how objects can be related to space-time regions (which we argue it does) then assessing different characterisations of ESRs is important for understanding the nature of those relations.

Much of the philosophical literature on the topic seems to take for granted that extendedness is an intrinsic property of regions. Either extendedness is taken to be the property of having proper parts (or the property of having proper parts with non-zero distances between them), or it is taken to be what we might call a *strongly intrinsic property*: a property had by a region in itself, and not one had in relation to its proper parts or to any other regions or objects.[[6]](#footnote-7) Only the latter view allows for the possibility of ESRs and indeed it seems to be the view held by typical proponents of ESRs.

The standard view of extendedness as strongly intrinsic is certainly appealing. Its primary virtue is that it preserves the intuition that size and shape are intrinsic, while also allowing that ESRs are possible. It is, however, not the only view of extendedness on which ESRs are possible, and it is not without its difficulties.

For an account of extendedness to allow for ESRs it must meet the basic requirement of making extendedness compatible with simpleness.[[7]](#footnote-8) An account of extendedness on which to be extended is to have proper parts, for instance, or to have proper parts which are spatially separated, is straightforwardly incompatible with ESRs. After all, ESRs have no proper parts, and therefore could not be extended on such an account. The standard view of extendedness allows for ESRs, but in principle there are many other views that fulfil this requirement. After all, the claim that extendedness is compatible with simpleness says little about what extendedness might be. It allows that extendedness might be a matter of the way some *other* thing’s proper parts are, for instance. And it allows that extendedness might be a relational property holding between a region and some other regions. In what follows we explore a non-standard view of extendedness that allows for the possibility of ESRs. As we will see, this non-standard view avoids some of the problems which have been raised for the standard view in recent years.

1. **A non-standard view of extendedness**

The non-standard view of extendedness we propose is one on which extendedness is taken to be not an intrinsic or strongly intrinsic property of regions, but an extrinsic, relational property. On this view, a region’s extendedness is a matter of its relation to some other entities, perhaps including that region’s proper parts (if it has any). An ESR, on this view, is a simple region that has this extrinsic extendedness property.

What kind of extrinsic property might extendedness be? More specifically, what other entities might be responsible for a region’s extendedness? One answer is that facts about a region’s extendedness are just facts about the distance relations that hold between surrounding regions.[[8]](#footnote-9) In other words, to say that a region is extended is to say that it fits into a surrounding network of regions in a certain way. To get the rough idea, consider line segments, A, B, and C as in Figure 1 below:

C

B

A

*Figure 1.* Three contiguous line segments, A, B, and C.

B is extended and (let us say) 2cm in length. A and C are separated by a least-distance of 2cm. On the standard view, B’s extendedness is an intrinsic property. Claims about B’s extendedness are about B and B alone, and we need only consider B if we wish to know whether B is extended. On the non-standard view, claims about B’s extendedness are about B *and* its surrounding regions (i.e., A and C), and we need to consider all of A, B, and C if we wish to know whether B is extended. On the non-standard view, B is extended because A and C are each adjacent to B but are far from each other, and B’s extendedness *consists in* this relation it bears to A and C.

This idea derives support from the observation that we can deduce that B is extended from facts about the least distances between the three regions. Given that the (least-)distance between A and B is zero, that the (least-)distance between B and C is zero, and that the (least-distance between A and C is *non*-zero, we can deduce that B is extended. More generally, we can deduce that B is extended on the grounds that the least-distance between A and C is greater than the sum of the least-distances between A and B and between B and C.

This suggests the following extrinsic analysis of extendedness:

**EXTRINSIC EXTENDEDNESS (EE):** (For any region *r*) *r* is extended = there are some regions *x* and *y* such that the least-distance from *x* to *y* is greater than the sum of the least-distance from *x* to *r* and the least-distance from *r* to *y*.

Notice the connection between EE and the triangle inequality. A key idea in geometry is that if *x, y, z* are points, then the distance from *x* to *z* is no greater than the sum of the distance from *x* to *y* with the distance from *y* to *z*. EE turns this idea around and says that *for* a region *y* to be point-sized (i.e., unextended) is for it to not violate the triangle inequality (when ‘distance’ is interpreted as ‘least-distance’). (Here and in what follows, we will take distance (*simpliciter*) to be *least-*distance.)

To get a better grip on EE, it may be helpful to consider some examples. First, note that EE entails that any *composite* region *r* with parts *s* and *t* that are a non-zero distance from each other will be extended. This is because the least distance from *s* or *t* to *r* is zero, so the sum of these distances is zero, which is strictly less than the non-zero distance from *s* to *t*.

Furthermore, consider a world whose regions are exactly like ours, then imagine deleting a sphere-shaped (composite) region *r* and its parts. Now imagine “filling the gap” left by *r* with a simple region *r\**, such that *r\** bears the exact same distance relations to the other regions that *r* used to. EE entails that *r\** is thus extended: take two points that used to flank *r*—they are now each close to *r\** but far from each other, violating the triangle inequality.

Finally, imagine doing the same replacement process but with *r* in this case being a point-sized region (in our world, say). The region that replaces it, *r\**, again bears the same distance relations to the outside world that *r* did. Since, in our world, the triangle inequality holds of point-sized regions, it will hold of *r\** as well, guaranteeing that *r\** is unextended.[[9]](#footnote-10)

It is important for us to make EE plausible before moving on to its applications. To do so, we will list some benefits of the analysis, then defuse some objections. One apparent benefit of EE is that it is ideologically parsimonious—by defining extendedness in terms of least-distance, we seem to have cut down our number of primitives by one. This is, to some extent, a false economy. The reduction of just one aspect of the general concept *size and shape* matters little for ideological parsimony when there are many other size-and-shape concepts that remain in need of analysis (*being triangular*, *being the same shape as*, *being 1-meter wide*, and so on). Analogously, a reduction of *blueness* (to, say, light-reflecting properties) would not count much towards ideological parsimony in the absence of a reduction of colour more generally. We hope that EE can be extended to an analysis of size and shape in general, but won’t attempt to provide one here. Of course, anyone who believes that EE is true is obliged to believe that shape in general is extrinsic, but need not believe that facts about least-distance are by themselves sufficient in the general case.

One substantive benefit of EE is that it explains *why* points satisfy the triangle inequality—if they didn’t, then they wouldn’t be points. If one takes extendedness to be intrinsic, then this fact is difficult to explain. This is because there is no hope of defining distance or least-distance in terms of shape, so we would likely have to take both least-distance *and* extendedness (or at least some pair of distance-concept and shape-concept) as primitive.[[10]](#footnote-11) Then it is hard to justify why distances cannot be recombined with shapes to get whatever result. It’s correspondingly difficult to rule out bizarre cases like the following:

*Corridor*: Take a world exactly like ours, but with a simple region *r* standing in the same least-distance relations as an actual chunk of space that in our world forms a thin corridor from Sydney to Los Angeles. The corridor, let’s suppose, starts 1 meter from the opera house and ends 1 meter from the Hollywood sign. Despite having the same distance-relations as the corridor, *r* is point-sized.

Another benefit of EE is that it not only dictates that ESRs are possible, it explains what they are *like*. For under EE, the only difference between an ESR and an ordinary point-sized simple region is extrinsic. So an ESR is intrinsically the same as a point given EE. For someone who believes that extendedness is intrinsic, however, ESRs are thoroughly mysterious—what makes the difference, on the intrinsic view of extendedness, between an ESR and a point? This mysteriousness is evidenced by our discussion in Section 3, wherein we see that EE clarifies the puzzling cases of Kleinschmidt (2016) and Spencer (2010). Since Kleinschmidt’s and Spencer’s cases are so puzzling, that EE solves the puzzles is a good reason for a believer in ESRs to believe EE.

There are further arguments to be made in favour of EE, each of which might be considered responses to objections. The first involves justifying the use of least-distance as primitive. There are two objections to be made here: one might object that least-distance is derived, or one might object that there are other primitive kinds of distance (like greatest-distance or average-distance) in addition to least-distance.

With regards to the first point, note that least-distance has a good claim to being distance *simpliciter*. For consider two objects in contact with one another—it doesn’t make sense to say that the distance (*simpliciter*) between them is anything more than zero. Or consider two infinite parallel lines—the distance (*simpliciter*) between them seems to be their least-distance. Furthermore, least-distance is what we *actually* consider when we gauge the shapes of objects—since most objects are opaque, we gauge their shape by (roughly speaking) considering the least-distance from our eyes to various parts of the surface of the object.

The second suggestion, that least-distance may be just one primitive distance-concept among many, is ideologically unparsimonious. This lack of parsimony is especially troubling when there is an obvious definition of greatest distance for pointy regions (the greatest-distance between two regions is the greatest least-distance between their parts). We see no reason to reject this definition when ESRs or other deviant regions enter the picture. Allowing two primitive distance relations also opens the door to horrendous results via recombination—if greatest-distance and least-distance are both fundamental, then how are we to rule out a world where two objects are 2 meters from each other in terms of least-distance but 1 meter from each other in terms of greatest distance?

The second argument is a response to objections that argue that EE erroneously rules out cases like the following as analytically impossible:

*Lonely ESR*: *r* is the only region. It is both simple and extended.

(Alternatively take *Sociable ESRs*: *s* and *r* are the only two regions, they are both simple and extended.)

On EE, *Lonely ESR* is impossible because there aren’t enough regions for *r* to violate the triangle inequality, so *r* must be unextended. (So too *Sociable ESRs*.)

On the other hand, if we take extendedness to be intrinsic, then the possibility of *Lonely ESR* seems to follow from recombination (imagine starting with an ESR in a populous world, then deleting the other region).

EE is guilty as charged. However, we would argue that it is not clear that we *shouldn’t* rule out cases like *Lonely ESR*. We have two main reasons. The first is that, when probing one’s intuitions regarding the possible arrangements of regions, it is difficult to avoid surreptitiously imputing additional structure on the regions in question. In other words, it is difficult, when imagining some regions, to avoid imagining those regions *as shapes embedded into space*—the regions *are* the space, they can’t be *put* anywhere.

When confronted with intuitions that Lonely ESR is possible, our strategy is to deflate those intuitions by accusing them of sneaking in extra regions. What the believer of EE must oppose is not the “mental picture” that seems to rule in favour of Lonely ESR, but *that* this mental picture is *of* a lonely region. In other words, what the EE-believer must oppose is that we can simply imagine regions as having certain shapes without presupposing features of a larger space that the regions are situated in.

To illustrate how this strategy works, try to imagine a lonely cube-shaped simple region. Presumably, a picture of a cube pops into your head, but that would have happened if you were imagining a complex cube-shaped region, or a cube-shaped simple region surrounded by pointy space. It’s hard to see what extra work you could have done to make sure that your imagining is not of one of those possibilities. So these imaginings don’t decisively rule in favour of Lonely ESR. Consequently, it is fair game for EE to rule out Lonely ESR. The same strategy should apply in other cases where a counterexample to EE can apparently be conceived.

Indeed, any “visualisation” of a possible region implicitly presupposes that there is a *vantage point* from which the region in question is visualised. And presupposing there to be such a vantage point, as well as enough space in between you and the region that you can appreciate the region’s extendedness, gives enough regions for EE to get the right result.

(Here’s how this might work: Suppose that Sally can see that some region *r* is extended. Then there will be two rays extending from her eyes to *r* such that there is some non-zero distance between *r*1 and *r*2 where they reach *r*. Grant that these rays have no ESRs as parts (for their being ESRs either complicates things greatly or presupposes that EE is false). So we may take points (or very small parts) *p1* and *p2* from *r­­­1* and *r2* respectively such that the points are close enough to *r* that the distance from *p1* to *r* plus the distance from *r* to *p2* is strictly less thanthe distance from *p1*to *p2*.)

The second reason for which one might be happy to rule out *Lonely ESR* is that it seems to stand or fall with some intuitively problematic cases. Consider the following:

*Toasters*: The world *W* is almost the same as ours when it comes to regions; in particular, the simple regions of *W* bear the exact same least-distance relations to one another as the point-sized regions in our world bear to each other. Each simple region in *W*, however, is the size and shape of a toaster.

EE rules out Toasters, because it guarantees that each simple region in the world in question is unextended. Toasters stands or falls with Lonely ESR because it can be motivated both by recombination (take a toaster-shaped lonely ESR then put many duplicates of it together in the arrangement that the points in our world have) or by “visualisation” (if one may visualise Lonely ESR—as the believer of EE must deny—presumably one can also do so for Toasters: imagine stepping into a higher dimension to see that the simple regions are toaster-shaped). Toasters is problematic because, if it is possible, we could be *exactly* right about how our regions fit together, while being *completely wrong* about the shapes of the regions. This is because in the world of Toasters, *everything* seems just like it does in our world—the regions fit together in just the same way the corresponding regions do in our world, there is just no vantage point from which the shape of the simple regions would appear to be anything besides point-sized. But it seems like, given all this, we couldn’t be wrong about the shapes of the regions. So we judge it reasonable to deem Toasters impossible as EE does.

1. **Putting ESRs to work**

ESRs have been put to work in various ways, typically within a context in which it is assumed that both spacetime and objects exist and are distinct, with the latter bearing location relations to the former. ESRs are appealed to with a view to better understanding the ways in which the mereological structure of objects can (or cannot) come apart from the mereological structure of the regions those objects occupy. In what follows we argue that the ways in which ESRs have been deployed in the literature requires that we take extendedness to be intrinsic rather than extrinsic.

In what follows we outline two recent arguments due to Kleinschmidt (2016) and Spencer (2010), whose soundness, we argue, depends on accepting the standard, strongly intrinsic, characterisation of extendedness. The arguments proceed as follows:

*Kleinschmidt’s Place Case Argument*

1. If ESRs are possible, then Place Cases are possible (we will define Place Cases momentarily).
2. If Place Cases are possible, then there must be two or more primitive locative notions.
3. If there are two or more primitive locative notions then either (a) there are inexplicable connections between the corresponding relations, which restrict their recombinability or (b) these relations are freely recombinable, yielding as possible scenarios that are intuitively impossible.
4. Both (a) and (b) are false.
5. Therefore, there are not two or more primitive locative notions (from 4, 3).
6. Therefore, Place Cases are impossible (5, 2).
7. Therefore ESRs are not possible (6, 1).

*Spencer’s Heterogeneous Simples Argument*

(1) If it is possible that there is a heterogeneous simple that is exactly located at an extended composite region of space, then it is possible that a heterogeneous simple is exactly located at an extended simple region of space.

(2) It is not possible that there is a heterogeneous simple that is exactly located at an extended simple region of space.

(3) So, it is not possible that there is a heterogeneous simple that is exactly located at an extended composite region of space.

We think that neither argument is sound if EEis the correct analysis of extendedness.

**3.1 Kleinschmidt’s Argument**

Let’s start with Kleinschmidt’s argument. Kleinschmidt argues that if ESRs are possible then so too are what she calls “Place Cases”, cases which involve ESRs containing objects which are smaller than them. But, she argues, the possibility of Place Cases requires more than one primitive locative notion, and thus we should reject the possibility of ESRs.

A simple Place Case is *Almond in the Void*, which we present a version of below:

*Almond in the Void*

There is an extended, simple region, *r*, and an almond which is smaller than *r*. The almond is entirely within *r* without filling it.[[11]](#footnote-12)

Contrast this to the unproblematic case of an almond in its shadow:

*Almond in its Shadow*

There is an extended, simple region, *r\**, and an almond which is exactly the same size and shape as *r\*.* The almond is entirely within *r\** and fills it.[[12]](#footnote-13)

If both cases are possible, then one primitive locative notion does not suffice to capture the difference between them. This leads to premise 2, and Kleinschmidt’s *reductio* of the possibility of ESRs.

Given the standard view of extendedness, Kleinschmidt’s premise 1 (that Place Cases are possible if ESRs are) seems compelling. She offers the following principle in defence of the premise.

**Possible Placement Permissivism (PPP)**:

“For any *x*, *l*, *r1*, and *w1*, if *x* bears locative relation *l* to region *r1* in world *w1*, than for any region *r2* and world *w2*, if *r2* in *w2* is both empty and the same size and shape that *r1* is in *w1*, then there is some world, *w3*, in which there is an intrinsic duplicate of *x* (from *w1*) that bears *l* to an intrinsic duplicate of *r2* (from *w2*).” (Kleinschmidt, 2016, p. 129)

If PPP is true, then Place Cases are possible. Or, more carefully, if PPP and the following claim about extended simple regions are true, then the three principles are too.

**Shape Matching:** if possibly, there is a region with size and shape *S*, then possibly, there is a simple region with size and shape *S*.

PPP and Shape Matching jointly entail that if some object (simple or complex) bears some locative relation to a region *r*, then for any possible empty region of the same size and shape as *r*, there is an intrinsic duplicate of that object which bears the same locative relation to an intrinsic duplicate of the empty region. So if a complex object, o, is contained within a complex region R, then there is a possible simple intrinsic duplicate of R, of the same size and shape, which contains an intrinsic duplicate of o. Given EE, however, the case for premise 1 is far less convincing. In fact, it seems false, and PPP implausible. We offer two arguments against Kleinschmidt’s premise 1: the *carving argument*, and the *reverse carving argument*. Both arguments are designed to show that Place Cases like *Almond in the Void* are impossible if EE is true.

The carving argument goes like this. Begin with a simple object *o* (e.g., Kleinschmidt’s almond) that is contained in a simple region *r*. Suppose for reductio that *o* doesn’t fill *r*—*r* must therefore be extended. Suppose also that, besides *o*, *r* is empty. Now imagine “deleting” all other entities in the world one by one, so that we are just left with *o* and *r*. Imagine this happening such that *o* and *r* are left undisturbed. Intuitively, whatever locative relations hold between *o* and *r* won’t change as a result of this process of deletion. Since *o* and *r* were such that *o* was contained-in-but-didn’t-fill *r*, that must be how they are at the end of the deletion process. But given EE, *r* must be point-sized after deleting all the other regions, and it is a conceptual truth (we take it) that if an object is located anywhere in a point-sized simple region, then the object fills it. So *after* deleting all the regions, *o* must fill *r*. So the deleting of the regions *must* have addled the locative relation that holds between *o* and *r*. But it seems to us that deleting regions in this way would not alter the locative relation holding between *o* and *r*, so we must conclude that, before the carving process, it can’t have been that *o* failed to fill *r*.

The reverse carving argument suggests the same conclusion. Again, start with an object (e.g., Kleinschmidt’s almond) and a region *r*, both simple. This time, however, suppose that *o* and *r* are lonely—*o* is contained in *r*, and there is nothing else. Given EE, *r* is point-sized and simple, so *o* *must* fill, and thus be exactly located at, *r*. Now suppose that we add regions to the world such that *r* becomes extended: cube-shaped, say. In adding these regions, we must fix the least-distances between the new regions and *r*. Now, plausibly, this fixes the least-distances between the new regions and *o* (as it is plausible that the least distance relations for an object are fixed by the least distance relations that hold of the region in which that object is exactly located). So no matter how we add regions to the world, *o* is going to “grow” as *r* does—it will remain filling *r* no matter how the regions are added and no matter how the least-distances are chosen. To complete the argument, note that it is very plausible that by adding surrounding regions to *o* and *r*, we can duplicate any world that *o* and *r* could be a part of where *o* is contained in *r* and nothing else is. It follows that, necessarily, if *o* is contained in *r*, then *o* fills *r*.

The driving idea behind the two carving arguments is that which locative relations an object can bear to a region isn’t dependent on facts about surrounding regions or objects. All that matters is what the region and object are like. Call this *Intrinsicality of Location*:

**Intrinsicality of Location:** If *r* is a region and *o* is a material object, and *l* is a locative relation, then whether an intrinsic duplicate of *o* can bear *l* to *r* is determined only by the intrinsic properties of *o* and the intrinsic properties of *r*.

Intrinsicality of Locationis incompatible with PPP given EE since PPP tells us that the size and shape of a region are what matter to what locative relations an object can stand in to it, and EE indicates that size and shape are extrinsic properties of a region (it’s hard to see how size and shape could fail to be extrinsic if extendedness is). Furthermore, any principle designed to do the same job as PPP will also be incompatible with Intrinsicality of Location given EE, since, as we have seen in the carving arguments, Intrinsicality of Location implies that Place Cases are not possible given that view. Any object located at an ESR must be exactly located at it. On the other hand, an object located at an extended *composite* region of the same size and shape need not be.

* 1. **Spencer’s Argument**

So far none of this shows that there is any problem raised for Spencer’s (2010) argument. We think there is, though, another reason to reject Spencer’s premise (1) given EE and Intrinsicality of Location.

(1) If it is possible that there is a heterogeneous simple that is exactly located at an extended composite region of space, then it is possible that a heterogeneous simple is exactly located at an extended simple region of space.

Spencer argues for (1) by reasoning that if a heterogeneous simple, *o*, is exactly located at some composite region *r*, then any intrinsic duplicate of *o* must be such that it can bear the same location relation (that is, exact location) to an extended simple region *s* that is a size and shape duplicate of *r*. As he puts it, we can imagine pushing *o* along, so that it moves from *r* to *s*: since *r* and *s* are the same size and shape, it should be that we can put *o* into *s*, if we could put it into *r*. Call this argument for (1) *the pushing argument*. PPP would also motivate (1) on the assumption that size and shape are intrinsic properties of regions, since then the size and shape of *r* is intrinsic, and PPP would guarantee that an intrinsic duplicate of *o* can bear *l* to *s* (which is an intrinsic duplicate of *s*). We have already seen that Intrinsicality of Location is incompatible with PPP, and the pushing argument is similar to PPP. Imagine pushing a complex object *o*, made of point-sized parts, into an ESR *r* that is as big as *o* is. Since EE + Intrinsicality of Location entails that whatever is contained in *r* also fills it, the very first part of *o* that enters *r* must fill *r* entirely. That is, *o* will look as though it grows an *r*-shaped bulb immediately as it enters *r*. Since *r* is immediately filled the moment *o* touches it, we have no reason to suppose that *o* can be squeezed into *r* (without changing *o*’s intrinsic properties) by pushing it more. Presumably, the same goes if *o* is simple. So the pushing argument doesn’t work given EE + Intrinsicality of Location.

Thus, EE combined with the plausible Intrinsicality of Location entails that both arguments fail to establish their conclusions. Kleinschmidt’s argument fails to support her claim that ESRs are impossible, even if the argument is sound given the standard view that extendedness is strongly intrinsic. And Spencer’s argument fails to establish that heterogeneous simples located at extended composite regions are impossible—again, even if the argument is sound given the standard view of extendedness.

1. **Conclusion**

Our aim has not been to argue that one ought to prefer EE to the standard view. Rather, we have attempted to show that EE is a genuine contender as an account of extendedness, and that given some other plausible principles, such as Intrinsicality of Location, various apparently possible scenarios are not in fact possible. Insofar as arguments in the literature appeal to one or more of these scenarios, their plausibility rests on the supposition that the standard view is true, and EE false. It is worth bearing this in mind before we draw firm conclusions on the basis of these arguments.

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1. Though we think nothing substantive hangs on this being so. [↑](#footnote-ref-2)
2. We remain neutral on whether space-time is distinct from objects and spatio-temporal relations (substantivalism) or derivative upon said objects and relations (relationalism). [↑](#footnote-ref-3)
3. We assume for present purposes that extended simple objects are possible. For more on this see Simons (2004), McDaniel (2007; 2009), Markosian (2004) and Braddon-Mitchell and Miller (2006). [↑](#footnote-ref-4)
4. The view that space-time is real, and not reducible to some more fundamental relations that obtain between objects, properties, or events. [↑](#footnote-ref-5)
5. See for instance Eagle (2016), Parsons (2007), and Gilmore (2013; 2014). [↑](#footnote-ref-6)
6. Here we deliberately avoid defining strong intrinsic properties as those properties an entity has in virtue of the way it itself is and not the way any other objects, including its proper parts, are. The reason for this is that it is difficult to know how to read the “in virtue of” in a way that is unproblematic. On perhaps the most obvious reading it implies the existence of worldly grounding relations, but it is not clear that belief in intrinsic properties ought to commit one to such relations, and nor is it clear that such a reading is the right one (see Marshall, 2015). [↑](#footnote-ref-7)
7. Similar points apply to extended simple objectsother than regions, though our focus here will be on extended simple regions only. Note that one can accept a certain account of extendedness in regions without accepting the same account for extendedness in objects, and *vice versa.* [↑](#footnote-ref-8)
8. Another possibility is that extendedness is a property a region has in virtue of which objects (exactly) occupy or could (exactly) occupy it (thanks to BLINDED for pointing this out). We cannot discuss such a view in detail here, though it is worth noting some immediate unappealing consequences of it. If extendedness is had in virtue of what occupies a region, then there can be no empty extended regions. On the other hand, if extendedness is had in virtue of what can occupy a region, then it seems impossible to explain why certain objects can occupy certain regions and not others (see Skow, 2007, section 5). For example, why can the region exactly occupied by an elephant be exactly occupied by that elephant and only by that elephant and other objects of exactly the same size and shape? Why not a pen? The intuitive answer is that the region can only be occupied by things of a certain size and shape because that’s the shape of the region. However, this answer isn’t available on the account of extendedness under consideration. On that account it seems it must just be a brute fact. [↑](#footnote-ref-9)
9. Of course, NSE has it that the triangle inequality holding of point-sized regions is analytic, but this may be controversial. It’s uncontroversial that the triangle inequality holds of the point-sized regions of this world. [↑](#footnote-ref-10)
10. This isn’t obvious, because the shapes of some regions will likely determine the distances between other regions—regions *r* and *s* are *x* meters apart iff the shape of the fusion *r + s* has one of the shapes that correspond to an *r* shape and an *s* shape being *x* meters apart. But specifying such classes of shapes seems impossible without appealing to distances. This is why we take it to be impossible to define least-distance in terms of shape. [↑](#footnote-ref-11)
11. See (Kleinschmidt, 2016, p. 122) [↑](#footnote-ref-12)
12. See (Kleinschmidt, 2016, p. 123) [↑](#footnote-ref-13)