MORE PROBLEMS FOR PARSIMONIOUS LOGICS OF LOCATION: A REPLY TO KLEINSCHMIDT

Michael J. Duncan

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In a recent paper Shieva Kleinschmidt has argued that if certain scenarios involving extended simple regions[1] are possible (so-called 'Place Cases'), then no logic of location with only one primitive locative notion (i.e., no 'parsimonious logic of location') will suffice to describe all of the locative possibilities.[2] Since almost all existing logics of location are parsimonious (and apparently for good reason) the argument is a considerable obstacle to the development of a satisfactory logic of location. Kleinschmidt suggests that the best way out of the difficulty is to deny the possibility of Place Cases by denying that extended simple regions are possible.

While I agree with much of what Kleinschmidt says, I disagree that the source of the problem is extended simple regions. I will argue that much the same problem arises even in cases not involving extended simple regions or indeed exotic regions of any kind. Thus, simply denying the possibility of extended simple regions will not save parsimonious logics of location.

I

Before discussing Kleinschmidt's argument, we will need to say a little bit more about logics of location. The purpose of a logic of location is to describe all of the ways that entities can

[1] An extended simple region is a region which is extended (in this case in space) but lacks proper parts.

[2] Shieva Kleinschmidt, "Placement Permissivism and Logics of Location", *The Journal of Philosophy,* CXIII (2016): 117–136.

be located in space (or time or spacetime), and how these locative relations relate to one another. To get a handle on how these logics work, it will be useful to introduce two locative notions and look at how they can be defined in terms of one another. Other locative notions appealed to throughout the paper should be intuitive enough without further explanation.[3]

The first notion we will need is *exact location*. An object's exact location is the region in space it exactly takes up and is thus a region which shares the same size and shape as the object, and stands in the same spatiotemporal relations to other entities as it does. The exact location of a tree, for example, is the tree-shaped region occupied by the tree. The second notion we will need is *weak location*. An object is weakly located at any region which is not entirely free of it. Weak location is the most general locative relation, covering all of the ways an object might be locatively related to a region.

Most logics of location take either the notion of exact location or the notion of weak location as primitive, and define the other notions in terms of it together with mereological and logical notions. The following is a common definition of *weak location* in terms of *exact location,* for example.

> WEAK LOCATION: x is weakly located at r $=_{df.}$ x is exactly located at a region which overlaps r.[4]

Exact location, on the other hand, might be defined in terms of *weak location* as follows.[5]

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[3] For a more detailed overview, and explanation of other locative notions, see *ibid*., section I.

[4] See e.g., Josh Parsons, "Theories of Location," in Dean Zimmerman, ed., *Oxford Studies in Metaphysics, Volume 3* (New York: Oxford University Press, 2007), pp. 201–32.

[5] *Ibid.,* p. 205.

EXACT LOCATION: x is exactly located at r $=_{df.}$ x is weakly located at all and only those regions which overlap r.

The fact that locative notions seem to be inter-definable in this way provides initial support for the idea that logics of location should be parsimonious. Why take both *exact location* and *weak location* as primitive, for instance, if each can be defined in terms of the other?

Kleinschmidt's argument demonstrates that things are not so simple.

II

The argument is based upon two cases involving extended simple regions:

ALMOND IN THE VOID: There is an extended, simple region, *r*, and an almond (and its parts) which is smaller than *r* and seems to be entirely located in *r*. Region *r* is otherwise empty, and there are no other regions.

ALMOND IN THE SHADOW: There is an extended, simple region, *r'*, and an almond (and its parts) which is exactly the same size and shape as *r'*, and which seems to be entirely located in *r'*. Region *r'* is otherwise empty, and there are no other regions. [6]

Kleinschmidt argues that the possibility of these (and similar) cases is incompatible with parsimonious logics of location for the following reason. If we endorse a parsimonious logic of location, then we only have one primitive locative notion with which to describe the two cases. Suppose that we pick a primitive that applies in one of the cases. Either that primitive will also apply in the other case or it will not. In other words, the primitive will either apply

[6] Kleinschmidt, *op cit.*, pp. 122–123 (her words). On the same pages are helpful figures illustrating the two cases.

in (a) both cases or (b) only in one. If it applies in both cases then our logic of location will be unable to distinguish between the two cases. If it applies in only one case, then our logic of location will be unable to describe the other case.

Take, for example, the primitive *weak location,* which applies in both cases. No difference between the cases can be captured with just this primitive since the almond is weakly located at *r* in *Void* and also weakly located at *r'* in *Shadow*. We can, of course, define other locative notions from our primitive, together with mereological and logical notions, as we have seen. However, notice that in each case there is only one locative fact to describe (the locative relation holding between the almond and *r* in *Void* and the almond and *r'* in *Shadow*), and the mereological (and logical) relations are the same (there is only one region with no proper parts in both cases). Since there are no mereological (or logical) differences, we cannot capture any locative difference between the two cases in terms of derivative notions either. Whichever derivative notions apply must also be the same. If, for example, we use the definition of *exact location* in terms of *weak location* from earlier, we have to say that the almond in *Void* is exactly located at *r* and the almond in *Shadow* is exactly located at *r'*, since each almond is (trivially) weakly located at all and only regions overlapping *r* or *r'*. Once again we have not been able to describe a difference. The problem, of course, is that there does seem to be one. Intuitively, the almond only partly fills *r* whereas it completely fills (and is exactly located at) *r'*. A logic of location should be able to describe this difference. The result is not particular to the primitive *weak location* either; the same will hold for any primitive which applies in both cases, and for the same reasons.

Now consider a primitive which applies only to one case. The almond has no exact location in *Void* and is exactly located at *r'* in *Shadow*, so *exact location* is an example of such a primitive. The good news is that we can distinguish between the two cases in terms of *exact location*. The bad news is that the locative relation the almond has to *r* in *Void* cannot be described at all. Again, we might try to describe it using derivative notions, but, as before, this will not help. If the almond lacks an exact location in *Void* then no notion defined in terms of exact location applies to it either.[7] This, of course, is a problem. The purpose of a logic of location is to describe all of the locative relations and how they relate to one another. If *Void* is possible, then there are some locative relations that a logic of location which takes *exact location* as its only primitive cannot capture. And the same holds for any other primitive which apples in only one of the cases. Thus, no parsimonious logic of location with a primitive which applies in only one of the pair of cases is correct.

Kleinschmidt concludes that a primitive which applies in only one case will not suffice to describe all of the locative possibilities, and a primitive which applies to both will not suffice to differentiate between them all. A logic of location with a primitive that applies to neither case gets the worst of both worlds. It fails to differentiate between the cases and also fails to describe them. Since these are the only possibilities, it follows—given one important assumption—that Place Cases are incompatible with parsimonious logics of location.

The assumption is that a workable parsimonious logics of location will, like existing logics, make use of only a locative primitive, mereological notions, and basic logical notions when it comes to defining non-primitive locative notions.[8] (The definitions of *weak location* and *exact location* given earlier demonstrate how this is done.) Call logics of this kind *typical*

[7] Here one might try to define the derivative notions in such a way that objects do not require exact locations in order to satisfy them: e.g., "an entity, *x*, is weakly located at a region, *r*, iff *if x* is exactly located somewhere, then *r* mereologically overlaps a region at which *x* is exactly located" (Kleinschmidt, *op cit.*, p. 124). However, Kleinschmidt points out that although this allows us to say that the almond is weakly located at *r* in *Void* despite lacking an exact location it also (wrongly) implies that any object which lacks an exact location (e.g., the number 7) is weakly located at every region. Thus, if some region other than *r* existed, the almond would count as weakly located at both *r* and that region, under this definition, despite intuitively only being weakly located in *r*.

[8] See *ibid.*, p. 130.

logics of location, and logics which don't make use of only these resources *atypical logics of location.* Without the assumption that a parsimonious logic of location will be typical in this sense, it does not follow from Kleinschmidt's argument that no parsimonious logic of location is compatible with the possibility of Place Cases. Although *Void* and *Shadow* are exactly alike with respect mereological and logical relations, they are not exactly alike in *all* respects besides locative ones. For example, the relative size and shape of the almond and region in *Void* differs from the relative size and shape of the almond and region in *Shadow*. Thus, there is the potential for an atypical parsimonious logic of location which appeals to these differences to define its derivative locative notions.

We could, for instance, define *proper containment* (which btains whenever an object fits inside a region but does not fill it) as follows: x is properly contained in r $=_{df.}$ x is weakly located at r, x is not weakly located at any region disjoint from r, and x is smaller than r. Then we might define *exact location* as follows: x is exactly located at r $=_{df.}$ x is weakly located at all and only regions overlapping r and x is the same size and shape as r. The resulting logic of location is parsimonious (having only one locative primitive: *weak location*) and yet would allow us to both describe and differentiate between *Void* and *Shadow.* (In *Void* the almond is properly contained in *r*, whereas in *Shadow* the almond is not properly contained in *r'* but instead exactly located there.)

Unfortunately, it is not clear how to define other locative notions along similar lines, and so other kinds of Place Case remain a threat. (How can we distinguish between an extended simple object which is partly located at two extended simple regions without filling either and an extended simple object which is partly located at both and fills just one, for example?) Indeed, similar problems apply more generally, for there does not seem to be a way of constructing an atypical parsimonious logic of location which will be able to capture all possible locative relations.

III

In my view, the argument for the incompatibility of Place Cases and parsimonious logics of location is a good one. Certainly, Place Cases appear to be incompatible with typical parsimonious logics of location, including common logics of location found in the literature. If Place Cases are possible, then, existing parsimonious logics need to be given up and unparsimonious or atypical logics of location adopted in their place.

This, of course, is no small cost, and Kleinschmidt suggests that we ought to respond by denying the possibility of extended simple regions and with them Place Cases. (Her argument is based upon two central premises. First, other ways of resolving the incompatibility of Place Cases and parsimonious logics of location are ineffective or implausible. Second, there is independent reason to doubt the possibility of extended simple regions, given that extendedness is naturally understood in terms of non-zero distance relations between an entity's proper parts.)

While I am sympathetic to the idea that extended simple regions are impossible, I disagree that this is a viable response. As we will see, much the same problem arises for parsimonious logics of location, even in the absence of extended simple regions. Ordinary regions and ordinary objects will suffice. Thus, the source of the problem is not extended simple regions, and denying their possibility cannot solve it.

If the source of the problem raised by Place Cases were the fact that *r* and *r'* in the *Void* and *Shadow* are extended simple regions, then we would expect for no similar problem to arise in cases exactly like these but lacking extended simple regions. Consider, then, two analogous cases—call them *Almond in the Void** and *Almond in the Shadow**—in which *r* and *r'* are composite regions which divide up into proper subregions in any way we might imagine. There are thus no extended simple regions in *Void** and *Shadow** and enough subregions regions for every object to have an exact location. On the face of it, the additional subregions in the two new cases make all the difference. We can now, for instance, describe both cases in terms of *exact location*. The almond in *Void** has an exact location at a proper subregion of *r*, whereas the almond in *Shadow** is exactly located at *r'*. Furthermore, if we define *proper containment* as follows, we can then correctly say that the almond in *Void** is properly contained in *r* and the almond in *Shadow** exactly located at *r'*.

PROPER CONTAINMENT: x is properly contained within r $=_{df.}$ x is exactly located at a proper subregion of r.

We can also describe a difference between the two cases in terms of *weak location*. The almond is weakly located at all and only subregions of *r'* in *Shadow**, whereas in *Void** there are proper subregions of *r* at which the almond is not weakly located. Indeed, using the definition of *exact location* in terms of *weak location* from earlier we can now correctly say that the almond is exactly located at *r'* but not at *r*. (Recall that in the original two cases involving extended simple regions this definition entails that the almond is exactly located at each of *r* and *r'*.)

The problem, however, is that distinguishing between *Void** and *Shadow** is not enough. Not only should a logic of location be able to distinguish between cases in which there are locative differences, it should be able to distinguish *all* of the locative differences between the cases. No typical parsimonious logic of location can do this if cases like *Void** and *Shadow** are possible. Doing away with extended simple regions gives us the resources to describe differences in the locative relations between the almond and the proper subregions of *r* and *r'*, but it does not give us the resources to describe the differences in the locative relations between the almond and each of *r* and *r'* themselves.

We found that in each of the two new cases the almond bears the relation of proper containment, as defined above in terms of *exact location,* to *r* and *r'* respectively. This, however, is not the same relation of proper containment that the almond in the original *Void* case bears to *r*. The almond in *Void* lacks an exact location and so cannot be properly contained at any region according to the definition above. And yet the almond certainly bears *some* relation to *r* which we want to describe as proper containment. The term "proper containment", then, is ambiguous: it describes (at least) two different kinds of relation. In one sense of the term, to say that the almond is properly contained in *r* is to say something about the locative relations that the almond bears to proper subregions of *r.* Here, proper containment is a combination of locative and mereological relations: it is the relation of being exactly located at a proper subregion of some region. In the other sense of the term, to say that the almond is properly contained in *r* is to say that a locative relation holds between the almond and *r*. Proper containment in this sense is not a mixed locative-mereological relation; it is another *purely* locative relation like exact location.

(Consider an analogy with monadic colour properties. There are (at least) two different ways to think about the property of being partly green. On one, what it is to be partly green is simply to have a proper part which is green. Although in saying that the object is partly green we seem to be ascribing a certain monadic property, *being partly green,* to the object, what we are really ascribing to it is the relational property of having a proper part which is green. On the other, what it is to be partly green *is* to have a monadic property, different from the monadic property *being green* and different from the relational property *having a proper part which is green*. On this second view, to say of an object that it has a proper part which is green is to fail to fully describe it; for it also has the property *being partly green*. Similarly, to say of an object that it is exactly located at a proper subregion of some region may be to fail to fully describe the object's locative relations. After all, the object may also bear the (purely) locative relation of being properly contained in the region in question.)

As we have seen, the relation that the almond bears to *r* in the original *Void* case is a relation of proper containment in the second, purely locative, sense (analogous to the monadic property *being partly green*). Since we held fixed everything but the simpleness of *r* and *r'* when creating the *Void** and *Shadow** cases, it follows that the almond in *Void** is also properly contained in *r* in the second sense. In turn, it follows quite straightforwardly that saying that the almond is exactly located at a proper subregion of *r* is not enough to describe all of its locative relations.[9] That would tell us that the almond is properly contained in *r* in the first sense, but would say nothing about whether the almond is properly contained in *r* in the second sense. But the almond *is* properly contained in *r* in the second sense, and, if such a relation is possible, our logics of location should be able to capture this.

Kleinschmidt's argument, however, can be adapted to show that no parsimonious logic of location can achieve this result. If, on the one hand, we appeal to a primitive which can describe the (purely) locative relations between the almond and each of *r* and *r'*, then it will fail to distinguish between them. At best, we will be able to distinguish between the (purely) locative relations the almond bears to proper subregions of *r* and *r'*. Take the primitive *weak location*, for instance. All we can say is that the almond in *Void** is weakly located at *r*, and that the almond in *Shadow** is weakly located at *r**. The fact that we can describe differences in the ways the almond is weakly located at proper subregions of *r* and *r'* is beside the point. Those are differences in mereo-locative relations to *r* and *r'*; the difference we need to (and cannot) describe is a difference in purely locative relations. The same holds for any single primitive which describes the (purely) locative relations between the almond and *r* and between the almond and *r'*.

[9] It might of course be possible to *infer* what other locative relations the almond has from such a description, but we would not be able to make the inference within our logic of location.

If, on the other hand, we appeal to a primitive which can only describe one of these (purely) locative relations, then we will not be able to describe the other. At best, we will be able to describe all of the purely locative relations the almond bears to the proper subregions of *r* and *r'*. Consider the primitive *exact location*, for example. Since the almond in *Void** bears a purely locative relation to *r* which is not exact location, there is no way to describe it using *exact location* or any notion defined in terms of it in the typical way. As we saw earlier, saying that the almond is exactly located at a proper subregion of *r* misses the point, since this is not the relation we are trying to describe. The relation we are trying to describe is the same as the one that the almond in the original *Void* case bears to *r*. That cannot be a relation between the almond and a proper subregion of *r*, for *r* has no proper subregions. Thus, the relation between the almond and *r* in *Void** that we are trying to describe cannot be a relation between the almond and a proper subregion of *r* either, despite the fact that in this case *r* has proper subregions.

Here is the argument put slightly differently. There is a locative difference between the *Void* and *Shadow* cases. This locative difference is not a difference in how the almond is (purely) locatively related to proper subregions of *r* and *r'* (for neither has any). The same locative difference exists in the *Void** and *Shadow** cases (by stipulation). The only differences that can be described between *Void** and *Shadow** using a single primitive (and derivative notions) are differences in the way that the almond is (purely) locatively related to proper subregions of *r* and *r'*. Therefore, there is a locative difference between *Void** and *Shadow** which cannot be captured using a single locative primitive.[10]

[10] Here, as with Kleinschmidt's argument, a typical logic of location is assumed. The argument does not show that an atypical parsimonious logic of location cannot describe all of the locative differences between the cases. (There are, of course, reasons to doubt that an atypical parsimonious logic of location is feasible in the first place, however.)

It might be objected that no conclusions can be drawn about the locative relations in *Void* and *Shadow* if these cases are analytically impossible, and so the argument I have given does not go through. I am inclined to disagree that no such conclusions can be drawn; however, even if that were so, the problem for parsimonious logics of location does not depend essentially on this assumption. All that is needed is the analytic possibility of more than one kind of purely locative relation. Thus, if both senses of *proper containment* outlined earlier are coherent, as they seem to be, we can construct each of *Void** and *Shadow** without any reference to the original two cases and note that they differ not only with respect to the (purely) locative relations that hold between the almond and the proper subregions of *r* and *r'*, but also with respect to the (purely) locative relations that hold between the almond and each of *r* and *r'*. The same conclusion follows as before: no typical logic of location with a single primitive can capture the latter difference.

CONCLUSION

The source of the incompatibility between Place Cases and parsimonious logics of location is not that Place Cases involve extended simple regions, but that they involve more than one kind of purely locative relation. The problem for parsimonious logics of location is therefore much worse than it at first seemed. It would not be enough to solve the problem even to deny the possibility of every kind of exotic region or object. No typical parsimonious logic of location can capture more than one kind of purely locative relation, for no notion corresponding to one (purely) locative relation can be defined in terms of notions corresponding to others together with mereological and logical notions. This is easiest to see in the case of the two prevailing logics of location, which take either *weak location* or *exact location* as primitive. If we allow the possibility of Place Cases like *Void*, we can see that notions like *weak location* and *proper containment* in the latter logic do not have the same meaning as the corresponding notions in the former logic. Given the latter logic, but not the former, after all, the almond is not weakly located or properly contained anywhere, because it lacks an exact location.

But, of course, *Void*'s possibility or impossibility is really beside the point. Even if *Void* is impossible, this does not change the fact that the two prevailing logics of location contain two quite different sets of locative notions. Exotic possibilities (or impossibilities) merely reveal to us differences that are already there in ordinary cases. If these differences correspond to real locative possibilities, then neither of the two prevailing logics can capture them all, and nor can any other typical parsimonious logic. As we have seen, no single primitive which corresponds to a (purely) locative relation can fully describe pairs of cases like *Void** and *Shadow**, which involve two different kinds of (purely) locative relation. Either the primitive will describe only the (purely) locative relation in one of the cases and not the other, or it will describe them both, but fail to differentiate between them.

Thus, we face a dilemma: either we must deny the possibility of more than one kind of (purely) locative relation, or we must give up on parsimonious logics of location. (That or we need to find an atypical parsimonious logic of location which can describe all of the locative possibilities.)

Giving up on the possibility of more than one kind of (purely) locative relation is not appealing for two reasons. First, cases like *Void** and *Shadow** seem to be not only possible but actual; for *Void** and *Shadow** look just like ordinary cases of location. Second, if the purpose of a logic of location is to capture all of the analytic possibilities (and not just the metaphysical possibilities), then it is hard to see why we should think more than one (purely) locative relation impossible. Imagining and describing *Void** and *Shadow** does not seem to involve any kind of conceptual confusion.

This leaves us with the second horn of the dilemma. Perhaps it is time to start taking unparsimonious or atypical logics of location more seriously.