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## SORENSEN'S ARGUMENT AGAINST VAGUE OBJECTS

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In his fascinating and provocative paper, "Sharp Boundaries for Blobs," Roy Sorensen gives several arguments against the possibility of "vague objects," or objects with indeterminate boundaries.<sup>1</sup> In what follows, I will examine the main argument given by Sorensen in his paper. This argument has a great deal of initial plausibility. Moreover, I happen to sympathize with its conclusion. Nevertheless, it seems to me that Sorensen's argument fails to establish that conclusion. The purpose of this paper is to show why. I will argue that, upon careful examination, it can be seen that Sorensen's argument involves a fatal equivocation.

Sorensen's argument is based on a kind of thought experiment. We are asked to consider, as a paradigm example of a vague object, a grey sphere (also known as "the blob") that fades into a white background. And we are asked to imagine a spherical cavity growing from the center of the blob, so that the growth of the cavity eventually destroys the blob. Sorensen's argument, which is explicitly spelled out in Section I of his paper, goes like this:

1. The blob must have a boundary.
2. If a spherical cavity grows from the center of the blob, the blob's outer boundary is completely unaffected as long as some of the blob remains.
3. As soon as nothing remains of the blob, the blob's boundary goes out of existence all at once.
4. Lemma: The blob's boundary goes out of existence instantaneously.
5. Conclusion: The blob goes out of existence instantaneously.

The logical structure of this argument may seem a little bit puzzling, but I take it that premises 1-3 are meant to provide support for line 4, and that line 5 is supposed to follow from 4. That is, I take it that the argument contains an implicit premise that goes like this:

4a. If the blob's boundary goes out of existence instantaneously, then the blob goes out of existence instantaneously.

Another puzzling aspect of the argument is that it doesn't seem to reach its desired conclusion, namely, that the blob is not a vague object. But this problem too can be easily ameliorated by adding both the desired conclusion and a final implicit premise linking 5 with that conclusion. The implicit last part of the argument will look like this, then:

6. If the blob goes out of existence instantaneously, then the blob is not a vague object.

7. Final conclusion: The blob is not a vague object.

In order to evaluate this argument, it will be helpful to have a clear idea of what a "vague object" is supposed to be like. I take it that the standard definition would go something like this:

(D1) *x* is a *vague object* =df there is some *y* such that it is an indeterminate matter whether *y* is a part of *x*.

Sorensen's blob would, at first glance, appear to be an example of a vague object, since it is an indeterminate matter whether its outer parts are really parts of the blob. Another example of a vague object, according to Peter van Inwagen, would be a human who had recently swallowed some water. If a particular water molecule were partially caught up in the life of the person at a certain time, then it would be an indeterminate matter, according to van Inwagen's answer to his Special Composition Question, whether that molecule was a part of the person at that time.<sup>2</sup>

Now, it should be clear that the concept of a boundary plays a crucial role in Sorensen's argument, for the word 'boundary' appears in five different lines of the argument (namely, 1, 2, 3, 4, and 4a). But what exactly is a boundary? The intuitive (and dictionary) sense of the word seems to be something like this:

**The Intuitive Definition of 'Boundary' (ID):** *B* is the *boundary* of *x* =df *B* is what fixes the limit or extent of *x*.<sup>3</sup>

Unfortunately, this definition is not very helpful, since it raises the further question, 'What is it that fixes the limit or extent of an object?'

Luckily, we can come up with a more helpful definition of 'boundary'. To begin with, we will need to appeal to some of the definitions from Richard Cartwright's classic paper, "Scattered Objects."<sup>4</sup> (Note that Cartwright's definitions are based on the idea that a region of space is a set of points in space.)

(D2) The *complement* of region R =df the set of points in space not in R.

(D3) Region R is an *open sphere* about point p =df the members of R are all and only those points that are less than some fixed distance from p.

(D4) Point p is a *boundary point* of region R =df every *open sphere* about p has a non-null intersection with both R and the *complement* of R.

Once we have Cartwright's definition of the boundary point of a region, we can easily extend that notion to get a definition of the boundary of an object. All we have to do is adopt van Inwagen's definition (from his paper, "The Doctrine of Arbitrary Undetached Parts") of what it means for an object to occupy a region.<sup>5</sup>

(D5) Object x *occupies* region R =df R is the set containing all and only those points that lie within x.

Then we can easily define the notion of the boundary of an object as follows.

**A Cartwrightean Definition of 'Boundary' (CD):** B is the *boundary* of object x =df B is the set of all *boundary points* of the region *occupied* by x.

Although we now have a satisfying definition of the boundary of an object, it will be noted that something is amiss. The above definitions are based on the assumption from classical mereology that parthood does not come in degrees. But of course that assumption won't do for our present purposes. We want to allow for the possibility that parthood does come in degrees, as those who believe in vague objects – the targets of Sorensen's argument – say it does. Thus we'll need to consider an alternative definition of 'boundary'.

Philosophers who believe that parthood comes in degrees will want to say that the set of objects composing a vague object will be a "fuzzy set", i.e., a set whose members are each of them a member to some degree between 1 and 0, where 1 represents determinate membership

and 0 represents determinate non-membership. Similarly, such philosophers will want to say that the region occupied by a vague object will be a "fuzzy region", i.e., a region whose members are each of them a member to some degree between 1 and 0. To begin to arrive at a definition of 'boundary' that accords with this way of thinking, we can adopt the following definitions of 'determinate boundary point' and 'indeterminate boundary point'.

(D6) Point  $p$  is a *determinate boundary point* of region  $R$  =df every *open sphere* about  $p$  contains some point that is a member of  $R$  to degree 1 and some point that is a member of  $R$  to degree 0.

(D7) Point  $p$  is an *indeterminate boundary point* of region  $R$  =df (i)  $p$  is not a *determinate boundary point* of  $R$  and (ii) every *open sphere* about  $p$  contains two points with differing degrees of membership in  $R$ .

We will also want to talk about the degree to which a given point is a boundary point of a particular region. Intuitively, the idea is that a point is a boundary point of a region to the degree that that point marks the distinction between the region and its complement. Suppose, for example, that points on one side of a certain line are members of a particular region to degree 1, while points on the other side of that line are members of the region to degree .5 (see Figure A).

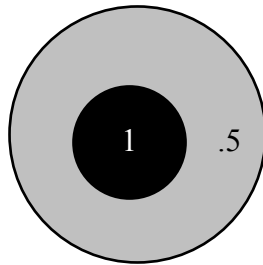


Figure A

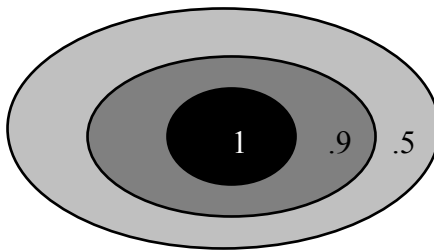


Figure B

Then any point on that line is a boundary point of that region to degree .5, since that is the degree to which any such point marks the distinction between the region and its complement. Similarly, if points on one side of a line are members of a particular region to degree .9, while points on the

other side of that line are members of the region to degree .5, (see Figure B) then any point on that line is a boundary point of that region to degree .4, since that is the degree to which any such point marks the distinction between that region and its complement.

Giving a rigorous definition of the intuitive notion of the degree to which a given point is a boundary point of a particular region turns out to be a somewhat tricky matter. But I am certain that the intuitive idea is a perfectly coherent one. In any case, I will assume in what follows that it makes sense to talk about the degree to which a given point is a boundary point of a particular region. The following definition of 'boundary', which allows for vague objects, is based on this assumption.

**A "Vague Objects" Definition of 'Boundary' (VOD):** B is the *boundary* of object x =df B is the fuzzy set of all *determinate* and *indeterminate boundary points* of the region occupied by x, and each member of B is a member of B to the degree to which it is a *boundary point* of that region.

Once we adopt VOD then we can define 'determinate' and 'indeterminate' boundaries as follows.

(D8) The *boundary* of object x is *determinate* =df the *boundary* of x contains only *determinate boundary points* of the region occupied by x.

(D9) The *boundary* of object x is *indeterminate* =df the *boundary* of x contains at least one *indeterminate boundary point* of the region occupied by x.

Although VOD and the accompanying definitions give us what I take to be an adequate conception of an indeterminate boundary – the kind of boundary that Sorensen's argument is supposed to show no object can have – there is one further notion of a boundary that we will have to consider. This is the definition of an "outer boundary", as mentioned in premise 2 of Sorensen's argument. Here is what seems to me a good definition of 'outer boundary'.

(D10) Point p is an *outer boundary point* of region R =df every *open sphere* about p contains a point that is a member of R to degree 0 and a point that is a member of R to some degree greater than 0.

**The "Outer Boundary" Definition of 'Boundary' (OBD):** B is the *boundary* of object x =df B is the set of all *outer boundary points* of the region occupied by x.

Now that we are armed with two senses of 'boundary' – those captured by VOD and OBD – that are potentially relevant to an ostensibly vague object such as the blob, let us re-examine

Sorensen's argument and ask ourselves, in the case of each line of the argument that contains the word 'boundary', which of our two definitions makes that line seem plausible. For starters, it seems to me that premise 1 is plausible on either VOD or OBD. For the blob will have a boundary in either of these senses.

Next, it should be clear that premise 2 is meant to be talking about the sense of boundary captured by OBD. For one thing, Sorensen actually uses the expression 'outer boundary'. For another thing, the growing of the cavity *would* affect the blob's boundary in the sense defined by VOD, since as the cavity grows it will eventually begin to wipe out portions of the blob that were parts of it to degrees less than 1, which means that it will affect the blob's boundary in the sense captured by VOD. (Note, by the way, that it is really the *existence of* the blob's outer boundary, and not the outer boundary itself, that remains unaffected by the growth of the cavity. For the boundary of the growing cavity will itself be part of the outer boundary of the blob, which means that the shape and size of the blob's outer boundary will be changing as the cavity grows.)

Meanwhile, I think that premise 3, like premise 1, is plausible if we take it to be using 'boundary' in the sense of either VOD or OBD. But a proviso is in order here. It might be objected against Sorensen that, since boundaries are sets of points in space, the blob's boundary – whether in the sense defined by VOD or in the sense defined by OBD – will not be affected by the disappearance of the blob, since the relevant points will continue to exist with or without the blob. I think, however, that to make this objection is to be uncharitable to Sorensen. For surely there is some sense in which the blob's boundary does go out of existence as soon as there is nothing left of the blob. We can characterize the relevant sense by saying that even if the region that was formerly the blob's boundary continues to exist after the blob goes out of existence, that region will cease to be the blob's boundary. And I take it that this is all that Sorensen means – and all he needs to mean for his argument to work – when he says that the boundary goes out of existence as soon as there is nothing left of the blob.

Now consider line 4. Is it plausible if we take 'boundary' to be defined as in VOD? I don't think so. The reason is that the boundary of the region occupied by the blob, in the sense defined by VOD, will have indeterminate boundary points as members. At some point before the complete disappearance of the blob, when there no longer remain any determinate parts of the blob, the blob's boundary will consist exclusively of indeterminate boundary points. And this means that as the blob passes through various stages of indeterminate existence between determinate existence and determinate nonexistence, so too will its boundary. After a period of such indeterminate existence, the insatiable cavity will finally overtake the last remaining indeterminate part of the once proud blob, sending the blob into the abyss of determinate nonexistence. Right at the same time, the last of the remaining points of the blob's indeterminate boundary will also cease to be boundary points of the blob. Thus the blob and its indeterminate boundary will meet their ultimate ends together, and in the same way: they will fade out gradually, after going through various stages of indeterminate existence.

It is a different story with the blob's boundary in the sense defined by OBD, however. Although the blob's outer boundary might contain some indeterminate boundary points, it will not contain any points that are only indeterminately members of the outer boundary. For membership in an outer boundary, unlike membership in a VOD boundary, cannot be an indeterminate matter. Each point must be either determinately a part of the outer boundary or else determinately not a part of the outer boundary.

So it looks like line 4 is false if we take 'boundary' in the sense defined by VOD, but true if we take 'boundary' in the sense defined by OBD. (Similarly, it looks like line 4 does not follow from 1-3 if we understand the occurrence of 'boundary' in line 4 in the sense defined by VOD, but also that line 4 does follow from 1-3 if we understand the occurrence of 'boundary' in line 4 in the sense defined by OBD.)

Finally, consider 4a, the implicit premise that I have suggested is needed to make the argument formally valid. I think it's clear that the only sense of 'boundary' that makes 4a plausible is the sense captured by VOD. For nothing about the pace of the blob's demise follows

from the claim that the blob's outer boundary goes out of existence instantaneously. It is perfectly possible – plausible even – that the blob should dwindle down to a mere .3, and then .2., and then .1 degree of indeterminate existence long before the blob's outer boundary instantaneously goes out of existence. That is, it is plausible that the blob itself fades gradually out of existence even though its outer boundary goes out of existence instantaneously. So it does not follow, from the claim that the blob's outer boundary goes out of existence instantaneously, that the blob itself must also go out of existence instantaneously. But it does follow from the claim that the blob's boundary in the sense captured by VOD goes out of existence instantaneously that the blob itself would have to go out of existence instantaneously, too.

According to what I have said, then, here are the senses of the word 'boundary' required to make plausible the different lines of the argument containing that word:

1. VOD, OBD.
2. OBD.
3. VOD, OBD.
4. OBD.
- 4a. VOD.

The bad news, of course, is that there is no single sense that makes every one of these lines plausible. The upshot is that Sorensen's argument fails to establish either its stated conclusion – that the blob goes out of existence instantaneously – or its desired conclusion – that the blob is not really a vague object. My own view is that this desired conclusion is true all the same, because each mereological simple in the vicinity of the blob is either determinately a part of the blob or else determinately not a part of the blob. But whether this latter claim can be plausibly defended by means of some other argument is a question for another place.<sup>6</sup>

## Notes

- <sup>1</sup> Roy Sorensen, "Sharp Boundaries for Blobs," *Philosophical Studies*, forthcoming.
- <sup>2</sup> See Peter van Inwagen, *Material Beings* (Ithaca: Cornell University Press, 1990).
- <sup>3</sup> See, for example, *Webster's New Collegiate Dictionary* (Springfield, MA: G. & C. Merriam Company, 1973).
- <sup>4</sup> Richard Cartwright, "Scattered Objects," in his *Philosophical Essays* (Cambridge, MA: The MIT Press, 1987), pp. 171-86.
- <sup>5</sup> Peter van Inwagen, "The Doctrine of Arbitrary Undetached Parts," *Pacific Philosophical Quarterly* **62** (1981), pp. 123-37.
- <sup>6</sup> This paper grew out of comments presented on the APA version of Sorensen's paper at the 1996 Pacific Division Meeting of the APA. I'm very grateful to Mark Aronszajn, Theodore Drange, Theodore Sider, Sharon Ryan, Roy Sorensen, an anonymous referee for *Philosophical Studies*, and participants at the APA session for helpful comments.