GUNKY OBJECTS IN A SIMPLE WORLD

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Abstract: Suppose that a material object is gunky: all of its parts are located in space, and each of its parts has a proper part. Does it follow from this hypothesis that the space in which that object resides must itself be gunky? I argue that it does not. There is room for gunky objects in a space that decomposes without remainder into mereological simples.

I. INTRODUCTION

Say that something is a *material object* just in case every part of that object is located at some region of space. Say that an object is *gunky* just in case every part of that object has a proper part. Suppose that space decomposes without remainder into zero-dimensional points, and that each point is mereologically atomic, i.e., simple. Does it follow from this supposition that no material object is gunky?

Note that space on this supposition is not gunky, and hence no proper part of space is gunky. This might lead one to claim that nothing gunky can be found in space, for where could it find a home? That is, one might accept the *gunk occupation thesis* (GOT):

(GOT): Necessarily, a material object is gunky only if it occupies a gunky region of space.

I will argue that GOT is false. Accordingly, there is room in a simple world for material atomless gunk.

II. OCCUPATION

Most of what will be said in this section has been said elsewhere, so I will be brief.[1] Briefly, I presuppose in what follows an ontological dualism of region and material object. Space is the arena in which material objects reside. These entities are brought together by a fundamental locative relation, which I call *occupation*. Since occupation is a fundamental relation, I cannot *analyze* it: the notion of occupation is taken here as primitive, and the facts of occupation form part of the fundamental supervenience base of the world.

I do not assume that, if an extended object occupies an extended region of space, then it occupies every-or any-sub-region of that region. In the typical situation, this is in fact not the case. I do not assume that, if an object occupies an extended region of space, then, for each (proper) sub-region of that region, that object has a proper part that occupies this region. (Although this typically is the case.) I do not assume that an object must occupy exactly one region of space; perhaps objects can be multi-located.

We can distinguish occupation from other locative relations by showing how these locative relations are (partially) defined in terms of occupation. Accordingly, the following definitions—taken from McDaniel (forthcoming),[2] but based on ideas from Gilmore (forthcoming)[3]—will be helpful:

> *x fills* region R = df. Either (i) there is some R' such that R is a part of R' and *x* occupies R' or (ii) there is a region R' and there are regions, the *r*s, such that R' is the fusion of the *r*s, *x* occupies each of the *r*s, and R is a part of R'.
>
> *x lies within* R = df. There is some region R' such that R' is a part of R and *x* occupies R'.
>
> R is *empty* = df. There is no *x* such that *x* fills R and there is no *x* such that *x* lies within R.
>
> *x partially fills* R = df. there are regions R' and R" such that (i) R = R'∪R", (ii) *x* fills R', and (iii) *x* does not fill R."
>
> *x uniquely occupies* R = df. *x* occupies R and no region other than R.
>
> *x* is *multi-located* = df. There are regions R and R' such that (i) R is not identical with R' and (ii) *x* occupies R and *x* occupies R'.
>
> *x covers* region R = df. R is the union of the regions occupied by *x*.[4]

Hopefully, the occupation relation has been successfully contrasted from these other locative relations, and the reader has grasped this primitive notion. With this hope, I proceed.

III. Gunky Space and Material Simples

In order to assess whether gunky material objects can reside in a world of simples, it will be useful to first address the question of whether simple objects can be found in a world in which space itself is gunky.

To keep things simple (no pun intended), we will focus first on a standard, infinite, Euclidean three-dimensional space that decomposes without remainder into points. This space decomposes into an infinite set of zero-dimensional objects, each of which bears some *distance* relation to the other elements in the set. The structure of space is settled by these distance relations: they determine the *shape* of each region of space.

Things are different in a gunky space. There are no points of space to bear distance relations to each other. It's true that points of space can be *modeled* by sequences of regions of space. For example, Peter Forrest provides one such model: an ersatz point may be thought of as an ordered set of spherical regions Rm such that, (i) if m is less than n, then Rn is a part of Rm, and (ii) the diameter of Rn approaches zero as n approaches infinity.[5] But these ersatz points aren't real points, since they do not belong to the same ontological category as regions. They are representations of what does not exist.

Once we assume that spherical regions have diameters of various lengths, we can "construct" ersatz points using set theory. We can even, if we like, assign ersatz "distances" to the ersatz points, for there are functions that take ordered pairs of ersatz points to real numbers that satisfy the constraints on being a distance function. But we shouldn't think that these ersatz distance relations that ersatz points bear to each other are genuine distance relations. Ersatz points are not parts of space, nor are they related via real spatial relations to real parts of space.

In fact, it is a kind of a category mistake to suggest that ersatz points are related to each other via real distance relations. We can see that this is so in a particularly vivid manner if we attend to the fact that we can "construct" ersatz points that are equally suitable for our purposes without appealing to set theory. For example, instead of identifying points with certain ordered sets, we could identify ersatz points with certain propositions. On this way of "constructing" "points" from regions, points may be thought of as propositions that state that there are concentric spheres of ever-shrinking diameter that are parts of each other. Each point could, if we like, be "identified" with a proposition that states of some series of regions that they are concentric, have their predecessors as parts, and are such that the limit of the diameters of these regions is zero. No one would take seriously the claim that these "points," which really are propositions about regions and their properties, are actually distant from one another or located in space. No proposition does or can bear any distance relation to any other.

That said, there is no problem with assuming that these ersatz points can be used to *model* the metrical features of gunky space. A regular Euclidean space is modeled by a set of "points" and a distance function defined on them, and it is assumed that any set of "points" represents some real region. A gunky space can be represented as well by a distance function defined on a set of "points"—where these are perhaps taken to be the ersatz "points" just mentioned; but not every of set of points is taken to correspond to a real region. Instead, only those sets of points that are regular open spheres represent real regions.

Explaining what the fundamental metrical facts in a gunky space comprise is tricky. One possibility is that the fundamental metrical facts in a gunky space are facts about the *diameters* of spherical regions; the rest of the metrical features of gunky space supervene on these facts.[6] I suspect that the intuitive picture of what gunky space would like will suffice for what follows, so we will not flesh out the technical details. Suffice it to say that in a gunky space, every region is a three-dimensional extended region of space: there are no points, lines, or planes to be found in a gunky region.

Is there room in a gunky space for material simples? Again, it might seem that the answer is *no*. But this would be premature. It is true that, *if* there are material simples in a gunky space, then these simples are *extended*, since to be material is to occupy some region of space, and every region of space is extended. But are extended material simples *impossible*? If they are not, there may yet be room for simple objects in a gunky space.

Elsewhere, I have argued that extended material simples are possible.[7] The defense of extended material simples depended on two claims. The first claim is that the *occupation* relation is a fundamental relation; this thesis was discussed in section II. The second claim is a Humean principle, according to which there are no necessary connections between distinct existences. This principle was formulated as follows:

> (NNC): Let F and G be accidental, intrinsic properties; let R be a fundamental relation; let *x* and *y* be contingently existing non-overlapping entities. Then it is not the case that, necessarily, R*xy* only if (F*x* if and only if G*y*).[8]

From these two claims, the possibility of extended simples follows: since being a simple is an accidental, intrinsic property and the occupation relation is a fundamental relation, it is possible that a simple object occupy an extended (non-simple) region of space.

An interesting—and in this context neat and helpful—feature of this argument is that it goes through even if the region in question is gunky. This shouldn't be too surprising. If we have a reason to think a simple object can occupy an extended region of space that decomposes without remainder into points, why shouldn't a simple object be able to occupy an extended yet gunky region of space? There seems to be no reason to allow the former while forbidding the latter.

I conclude that simple objects can be found in a world with gunky space. We will now determine whether gunky objects can be found in a world without gunky space.

IV. Gunky Objects in a Simple World

In order to make room for gunky objects in a simple world, I need to do two things. First, I need to either demonstrate that gunky objects are possible or at least undercut the best argument against gunky objects. Second, I need to show how there could be material gunk even if every spatial region decomposes without remainder into points.

I don't know how to prove the possibility of the existence of gunk save by pointing out that gunk seems to be robustly conceivable: we have mathematical models that we can interpret as representing the parthood structure and shape of gunky objects, namely the regular open sets that represent certain regions of Euclidean space: the shapes of these regions are represented by the distance relations defined on the members of these open sets, and the parthood relations are represented by the subset relation. Conceivability provides evidence for possibility.

But perhaps that evidence is defeated. In order to investigate whether this is the case, I will now turn to a discussion of a recent argument against atomless gunk. This argument comes from Hud Hudson.[9] Hudson begins by discussing two answers to the *Simple Question*, which was introduced into the metaphysics literature by Ned Markosian[10] and can be formulated as follows:

(SQ): What are the necessary and sufficient yet non-trivial conditions on being a material simple?[11]

Hudson mentions two answers to this question. First, there is the Pointy View of Simples, according to which a material object is a simple if and only if it is point-sized. Second, Hudson discusses Markosian's own answer to the simple question, according to which an object is a simple if and only if it occupies a maximally continuous region of space.[12] Markosian calls this view The Maximally Continuous View of Simples, or MaxCon.

We are now ready to present the over-all structure of Hudson's argument, which can stated as follows:

(1) Either MaxCon or the Pointy View is true.
(2) If MaxCon is true, then atomless gunk is impossible.
(3) If the Pointy View is true, then atomless gunk is impossible.
(4) Therefore, atomless gunk is impossible.[13]

(1) is not obviously true; there are many plausible answers to the Simple Question besides the Pointy View or MaxCon. In fact, elsewhere, I have argued that premise (1) is false. Instead of MaxCon or the Pointy View, I advocate the Brutal View of Simples, according to which there are no non-trivial necessary and sufficient conditions on being a simple. Very briefly, neither the Pointy View of Simples nor MaxCon can accommodate the possibility of co-located material objects.[14] This provides sufficient reason to reject (1), and hence declare Hudson's argument unsound.

Although Hudson's argument as it stands is unsound, there may be a better argument lurking in the wings. Specifically, Hudson's rationale for premise (3) itself raises a worry about the possibility of material gunk. Accordingly, let us ignore premise (2) and instead turn to Hudson's reason for endorsing premise (3):

(3.1) The Doctrine of Arbitrary Undetached Parts.
(3.2) Necessarily, no hunk of material atomless gunk exactly occupies a point-sized region of space.
(3.3) Necessarily, any hunk of material atomless gunk exactly occupies some region or other.
(3.4) Necessarily, any region has at least one point-sized subregion.

(3.5) Necessarily, any point-sized region is exactly occupiable.[15]

Although Hudson claims that premises (3.2), (3.4), and (3.5) are each supported by an appeal to the Pointy View of Simples, they have independent plausibility. Since (3.1)-(3.5) jointly imply the impossibility of material atomless gunk, it is worthwhile to examine this argument even if we reject the Pointy View. Hudson has this to say about the argument:

> From (3.1) through (3.5) we can get the conclusion that material atomless gunk is impossible. Suppose (toward reductio) that there is some hunk of material atomless gunk, H. So, by (3.2) and (3.3), H exactly occupies some non-point-sized region–hereby named 'R'. So, by (3.4) and (3.5), R has at least one exactly-occupiable, point-sized subregion—hereby named 'P'. So, by (3.1), H has a part—hereby named 'A'—that exactly occupies P. So, by (3.2), A fails to be gunk. But . . . every part of gunk is itself gunk. So, H fails to be gunk, too. Reductio complete.[16]

Let us begin by discussing premise (3.1). Recall what the Doctrine of Arbitrary Undetached Parts says:

> (DAUP): Necessarily, for every material object M, if R is the region of space occupied by M, and if sub-R is *any* occupiable sub-region of R *whatever*, there exists a material object that occupies the region sub-R and *which is a part of M*.[17]

Hudson claims that:

> Many are inclined to admit the possibility of material atomless gunk because they are attracted to a principle known as the Doctrine of Arbitrary Undetached Parts. . . . A historically popular argument to gunk from DAUP and a denial of point-sized objects observes that any extended thing will have a right half and a left half (given some orientation or other), and that the halves in question will each have a right half and a left half, and that the process continues without end. . . . It is hard to see how to motivate the possibility of gunk without something like DAUP, and thus I think the gunk theorists should be inclined to leave premise (3.1) alone.[18]

Let us note that it is possible for someone to reject DAUP and yet believe that gunk is nonetheless possible. I reject DAUP because I believe that extended simples are possible: anyone who embraces the possibility of extended simples must reject DAUP.

But I believe that material gunk is possible, because I believe that gunky material objects are conceivable and that their conceivability provides as of yet undefeated evidence of their possibility. As I see things, both extended simples and material atomless gunk are possible. We have similar reasons to believe that both are possible, specifically, that they are both conceivable. If you accept the possibility of extended simples, you must reject DAUP. Nonetheless, this does not necessarily undercut any motivation for accepting the possibility of material atomless gunk.

DAUP seems to play a major role in Hudson's argument, since it is DAUP that guarantees that, whenever a material object occupies a region of space, the mereological structure of the material object will be isomorphic to the mereological structure of the region.[19] If we reject DAUP, then we reject this necessary isomorphism.

Consider an extended region of space *r* that decomposes without remainder into points. Given that extended simples are possible, one should think that every three-dimensional sub-region of *r* is possibly occupied by an extended simple. So each subregion of *r* is possibly occupied by something that does not have zero-dimensional, one-dimensional, or two-dimensional parts.

Similarly, an advocate of gunk may hold that a gunky object could exactly occupy an extended region of space without having parts that correspond to the zero-dimensional, one-dimensional, or two-dimensional sub-regions of that region. For example, the object could occupy an open spherical region and have a proper part at every open sphere that is a sub-region of the region that it occupies, and in this respect would be unlike an extended simple. However, it would be like an extended simple in that it occupies a region that has zero-dimensional, one-dimensional, and two-dimensional parts, but does not have proper parts that occupy these sub-regions.

One could even hold that this is possible while accepting the Pointy View of Simples and the remaining premises of the argument. DAUP is the linchpin of Hudson's argument against gunk, but the friend of gunk need not be a friend of DAUP. I claim that both of Hudson's arguments against material gunk fail.[20]

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Notes

1. See Cody Gilmore, "Time Travel, Coinciding Objects, and Persistence," *Oxford Studies in Metaphysics* (forthcoming) and Kris McDaniel, "Extended Simples," *Philosophical Studies* (forthcoming) for more details. For a competing system that does not recognize the relation I call "occupation," see Josh Parsons, "Theories of Location," *Oxford Studies in Metaphysics* (forthcoming).

2. Kris McDaniel, "Extended Simples," *Philosophical Studies* (forthcoming).

3. Cody Gilmore, "Time Travel, Coinciding Objects, and Persistence," *Oxford Studies in Metaphysics* (forthcoming).

4. Gilmore (ibid.) introduces the notion of a "path" here: when *x* covers *R*, *R* is the *path* of *x*.

5. Peter Forrest, "From Ontology to Topology in the Theory of Regions," *The Monist* 7 (1996): 34–50.

6. This proposal is fleshed out in Peter Roeper, "Region-Based Topology," *Journal of Philosophical Logic* 26 (1997): 251–309.

7. See McDaniel, "Extended Simples."

8. A property is *intrinsic* just in case it characterizes the way an object is in itself. A property *P* is *accidental* just in case $\Diamond(\exists x\ x$ instantiates P and $\Diamond$ [x does not instantiate P]). As I noted in "Extended Simples," this Humean principle appears to be the principle that David Lewis appeals to in his argument against magical ersatzism; see pages 174–182 of *On The Plurality of Worlds* (Oxford: Basil Blackwell, 1986).

9. Hud Hudson, *A Materialistic Metaphysics of the Human Person* (Ithaca, N.Y.: Cornell University Press, 2001).

10. Ned Markosian, "Simples," *Australasian Journal of Philosophy* 76 (1998): 213–226.

11. A condition is trivial just in case its proper statement contains some bit of

mereological vocabulary.

12. A region of space is maximally continuous just in case (i) it is filled with matter, (ii) it is a continuous region, and (iii) it is not a proper sub-region of some continuous matter-filled region.

13. Hudson, *A Materialist Metaphysics of the Human Person*, 84–90.

14. See Kris McDaniel, "Brutal Simples," *Oxford Studies in Metaphysics* (forthcoming). Also, for specific criticism of MaxCon, see Kris McDaniel, "Against MaxCon Simples," *Australasian Journal of Philosophy* 81 (2003): 265–75.

15. Hudson, *A Materialist Metaphysics of the Human Person*, 88–89.

16. Ibid., 89. I have changed the numerals in Hudson's text so that the presentation of his argument matches what he says here. I trust that nothing important is lost by doing this.

17. DAUP is discussed in Peter van Inwagen, "The Doctrine of Arbitrary Undetached Parts," *Pacific Philosophical Quarterly* 62 (1981): 123–137; this is Hudson's formulation, which appears on page 88 of *A Materialist Metaphysics of the Human Person*.

18. Hudson, *A Materialist Metaphysics of the Human Person*, 88–89.

19. Strictly speaking, this holds only if every region is a *receptacle*, where a region of space is a receptacle just in case it is possible for a material object to exactly occupy this region. If certain regions are not receptacles—for example, point-sized regions—then DAUP does not imply that the mereological structure of a material object will always be isomorphic to the mereological structure of the region it exactly occupies. I hereby assume that every region is a receptacle.

20. I thank Jake Bridge, Andrew Cortens, and Hud Hudson for helpful discussion and comments on an earlier draft.