1. Introduction

An item is composed of mereological \textit{gunk} just in case each of its parts has proper parts.\textsuperscript{1} Philosophers have endorsed both the metaphysical and the epistemic possibility of gunk. Accordingly, interesting recent work has been done on the questions of whether actual physics is consonant with gunky spacetime and whether gunky matter may be located in the “pointy” spacetime of mainstream contemporary physics.\textsuperscript{2} To get clear about how these issues relate, some labels will be useful:

\textbf{(Gunk)}: There are worlds with the actual world’s physical laws that contain gunky material objects.

\textbf{(Adequate)}: At least one theory of gunky spacetime that is adequate for doing actual physics is either presently available or forthcoming.

\textbf{(Optional)}: There are worlds with non-gunky spacetimes that contain gunky material objects.

(Optional) is so-called because it leaves open whether an arbitrary spacetime that contains gunk is itself gunky. Call the negation of (Optional) ‘(Required)’ and the negation of (Adequate) ‘(Inadequate)’. Philosophers who endorse (Gunk) and are committed with respect to the other four theses divide into four camps, though the (Inadequate)/(Required) camp is likely to be empty since those two theses jointly
contravene (Gunk). The members of the (Adequate)/(Required) camp presumably are at peace with themselves, though both (Adequate) and (Required) are controversial. Present interest will be in the two remaining camps, the members of which endorse (Optional). The importance of (Optional) for any debate involving (Gunk) follows from the controversy surrounding (Adequate). If material gunk and actual physics are compossible and yet there is no hope for a physics-friendly theory of gunky spacetime, then material gunk and pointy spacetime are compossible.

This essay has three goals. The first is to show that a recent argument due to Hudson threatens (Optional)—the thesis that it is possible for material gunk to occupy pointy spacetime—in an important way that has gone unnoticed. The argument, which will be rehearsed in detail in section 4 below, deploys the mereological principle of weak supplementation:

**Weak Supplementation (WS):** Necessarily, for all material objects $x$ and $y$: if $x$ has $y$ as a part and $y$ does not have $x$ as a part then there is some material object, $z$, such that $z$ is a part of $x$ and $z$ does not overlap $y$.

In short, the argument is that since an arbitrary spatially three dimensional object $a$ in a pointy region will have some proper part $b$ that does not differ from $a$ in positive volume, WS (plus an ancillary premise ruling out co-location) secures that there is some further part $c$ of $a$ that lacks positive volume. This argument threatens (Optional) if it is understood as a claim about gunky objects all of whose parts have positive volume. Call gunk so understood ‘T-gunk’. Though T-gunk is an intuitive species of gunk, it is rarely
explicitly discussed. This may be why the threat posed by WS to the possibility of material gunk in pointy spacetime has not been appreciated.

The second goal of the essay is to motivate the T-gunk conception over alternative conceptions of gunk for material objects, thereby heightening the importance of the WS argument’s threat to (Optional).

The third and final goal is to defend (Optional) by showing that the WS argument is un compelling. The defense to be given turns on the controversial positive claim that if all parts of some material object \( x \) are spatially three-dimensional and if \( x \) is located at a pointy region then \( x \) exactly occupies more than one region. Multi-regional exact occupation allows the defender of (Optional) who endorses T-gunk to square her view with several independently plausible mereological principles, such as WS, that seem prima facie to be in tension with it.\(^5\)

Call the claim that material T-gunk is compossible with actual physics ‘the T-gunk reading of (Gunk)’. Call the claim that there is at least one possible non-gunky spacetime that contains a T-gunky material object ‘the T-gunk reading of (Optional)’. If the first goal of the essay is met, showing that the WS argument threatens to undercut T-gunk, and if the second goal is met, showing that the T-gunk readings of (Gunk) and (Optional) are indeed appealing, then the third goal, to defend (Optional) against the WS argument, ought to be of fairly general interest. Moreover, philosophers who hold that material T-gunk exists in distant possible worlds may endorse the T-gunk reading of (Optional) even if they reject the T-gunk reading of (Gunk). The present project ought to be of interest to these theorists as well. Finally, while the essay is structured around (Gunk) and (Optional), the original WS argument is aimed at \( T\text{-}theory \), the thesis that all
material objects—not just gunky ones—must have positive volume. The counter-argument from multi-regional exact occupation should be of interest to those attracted to this more general thesis independently of their views on the possibility of gunk.

2. T-Theory and T-Gunk

T-theory is the thesis that, necessarily, all material objects are of non-zero measure in every spatial dimension. Intuitively, the thesis is that all material objects have positive volume. If T-theory is true then zero-, one-, and two-dimensional regions are ineligible for exact occupation by material objects.

A material object is composed of T-gunk just in case each of its parts (i) has proper parts and (ii) is of non-zero measure in every spatial dimension. To see how T-theory, T-gunk, and the WS argument relate, consider the following claim.

(T-Gunk): Possibly, there is a class of material objects \( C \) whose members (i) consist of all and only the parts of some gunky material object and (ii) are each of non-zero measure in every spatial dimension.

(T-Gunk) says that it is possible that at least one T-gunky object exists. Notice that clause (ii) of (T-Gunk) predicates the same condition that T-theory says is met by all material objects. This similarity is key to understanding how T-theory, T-gunk, and the WS argument relate. The WS argument against T-theory proper concerns an arbitrary spatially three-dimensional material object in pointy space and attempts to show that the object has at least one less-than-three-dimensional part. Since T-gunky objects are
spatially three-dimensional, the argument applies to any T-gunky object in pointy space. Specifically, it threatens to show that clause (ii) of (T-Gunk) fails to hold at any world where spacetime is pointy. It thus threatens to show that the T-gunk reading of (Optional) is false.

3. Why Care About T-Gunk?

Before getting to the details of the WS argument, it will be worthwhile to motivate the T-gunk conception of material gunk and the associated reading of (Optional). One way that a material object may be gunky without being T-gunky is for it to be point-sized. What is required is an infinite collection of co-located point-sized objects, each of which has at least one of the others as a proper part. Call this ‘crowded point gunk’. Another way for a material object to be gunky without being T-gunky is for it to be extended in at least one but no more than two spatial dimensions. Call this ‘thin gunk’. A third alternative to T-gunk posits spatially three-dimensional gunky material objects that have at least one thin or crowded point gunky part. Call this ‘fit gunk’. The crowded point, thin, and fit conceptions are all tenable with respect to gunky material objects. What matters for present purposes, however, is that none of these alternatives detracts from the importance of the T-gunk reading of (Optional).

Consider crowded point gunk first. (Optional) is uninteresting if interpreted as being about crowded point gunk. If a gunky material object can exactly occupy a point, it follows that (Optional) is true. Simply consider a spacetime composed of exactly one point. On the plausible assumption that distinct spacetime regions are never co-located, the spacetime in question cannot be gunky; yet it can contain a crowded point gunky
material object. A second problem with crowded point gunk is that it requires material co-location. Gunk and co-location ought to be kept independent.

Nor does thin gunk provide reason to doubt the importance of the T-gunk reading of (Optional). Since most of the material objects used, named, and thought about by philosophers and non-philosophers alike are spatially three-dimensional, the most interesting debates over (Optional) will be those that take it to range over such objects.

This leaves fit gunk. The problem for fit gunk is how to keep it from bottoming out in crowded point gunk. Consider, without loss of generality over possible fit gunky objects, a perfectly solid cube, $a$, one proper part of which is a square plane, $b$. Metaphorically speaking, there is a zero-volume-proper-parts-yielding “chopping” mechanism that applies to $a$ along the spatial dimension in which $b$ has no non-zero extension, a mechanism fit to produce more thin proper parts of $a$ than merely $b$. After all, there is no reason to hold that while the two-dimensional region exactly occupied by $b$ at a given time contains a part of $a$, distinct parallel two-dimensional regions that are contained in the region exactly occupied by $a$ do not contain parts of $a$. Nor is there any reason to hold that this metaphorical mechanism must only be applicable with respect to one particular dimension. In the most intuitive cases, it will apply equally to $b$ along one of the other spatial dimensions, yielding a line-like object $c$ that is a part of $b$ (and thus a part of $a$). Yet again there is no reason to deny that the mechanism might apply to $c$ along the remaining spatial dimension, yielding a point-sized object, $d$. If this much is granted, however, then $d$ is a proper part of $a$. So, given that $a$ is gunky and $d$ is point-sized, either a contradiction has been reached (on the assumption that no gunky items are point-sized) or else $a$, an arbitrary fit gunky object, has been shown to decompose into crowded point
gunky parts. But this second disjunct renders the fit-gunk reading of (Optional) both uninteresting and dependent on co-location.

An important premise in the argument just given is the claim that the parts-yielding “chopping” mechanism applies generally across dimensions for sufficiently many material objects at sufficiently interesting worlds. Call this the ‘Chopping Thesis’. The clearest objection to the argument seems to be to reject this premise. But to do so would be ad hoc. The Chopping Thesis is highly intuitive and appears immune to principled objection, even if some small subset of possible three-dimensional material objects are composed of “un-chop-able” fit gunk. The claim that the most important and interesting debates involving (Optional) are those involving fit-gunky objects is thus problematic. The defender of this claim has no argument against the Chopping Thesis. Yet if he accepts the Chopping Thesis then his view bottoms out in crowded point gunk, rendering (Optional) uninteresting and dependent on co-location.

These considerations suggest that the T-gunk reading of (Optional) is at least as important as any competing reading of (Optional). Indeed it is reasonable to conjecture that even though it has not had center stage in the literature, the T-gunk conception underlies the intuitions that convince many theorists to accept that material gunk is possible in the first place.

So concludes the motivation for T-gunk. In the next section, focus will shift to Hudson’s actual WS argument against T-theory proper, rather than saying at each step how it can be modified to apply to the T-gunk reading of (Optional). Likewise, the response to the argument will be made on behalf of T-theory. At the close of the essay, the discussion will return from its focus on T-theory to explain briefly how the arguments
bear on the T-gunk reading of (Optional). The application is straightforward. For the next several sections, however, concern about gunk will be set aside.

4. The Weak Supplementation Argument Against T-Theory

T-theory bars material objects that are extended in fewer than three spatial dimensions, but its adherents, much like the friend of (Optional), may well accept the compossibility of material objects and zero-, one-, or two-dimensional regions. Accordingly, the T-theorist needs a story about parthood and occupation that allows for less-than-three-dimensional regions while remaining consistent with T-theory. The following principle is a good start.  

**T-Theoretic Proper Parthood (TPP):** Necessarily, for any material object, \( x \), region which \( x \) exactly occupies, \( R \), and proper subregion of \( R \), \( r \): \( r \) is exactly occupied by a proper part of \( x \) just in case \( r \) is of non-zero measure in every spatial dimension.

Hudson gives two versions of the WS argument. The first is directed at T-theory plus TPP; the second is directed at T-theory plus the following stronger principle:

**(TPP*):** Necessarily, for any material object, \( x \), region which \( x \) exactly occupies, \( R \), and proper subregion of \( R \), \( r_1 \): \( r_1 \) is exactly occupied by a proper part of \( x \) just in case (i) \( r_1 \) is of non-zero measure in every spatial dimension; (ii) there is some subregion of \( R \), \( r_2 \), which is of non-zero measure in every spatial dimension; (iii) \( r_1 \) and \( r_2 \) do not overlap; and (iv) \( R \) is the union of \( r_1 \) and \( r_2 \).
If the following principle is conjoined with WS then a counterexample to each of T-
theory, TPP, and TPP* may be generated:

**Contra-TPP (CTPP):** Necessarily, for any material object \( x \), region which \( x \) exactly
occupies, \( R \), and subregion of \( R \), \( r \), where \( r \) is obtained by subtracting some zero-, one-,
or two-dimensional region from \( R \): if \( r \) is exactly occupied by some part of \( x \) (call it ‘\( y \)’)
then \( y \) is a *proper* part of \( x \).

Here is how to get the counterexample. Consider a material object \( a \) and one of its parts \( b \)
such that \( a \) exactly occupies a region that is one point “larger” than the region exactly
occupied by \( b \). CTPP tells us that \( b \) is a proper part of \( a \), which entails (given classical
extensional mereology) that \( a \) is not a part of \( b \). WS then tells us that there is some
material object \( z \) that is a proper part of \( a \) and does not overlap \( b \). Given the ban on co-
location, it follows that any object eligible to play the \( z \) role must exactly occupy the
point that marks the difference between \( a \)’s region and \( b \)’s. But any such object is zero-
dimensional; and since it is a proper part of a material object, it is a material object. So
WS plus CTPP generates a counterexample to T-theory, TPP, and TPP*. Notice, by
contrast, that WS alone is quite consistent with each of T-theory, TPP, and TPP*.

Finally, here are Hudson’s arguments, upon which the above counterexample is
modeled.

**Version 1:** Consider *Sphere*, a perfectly solid material sphere no part of which is co-
located with any distinct material object. Consider the connected region exactly occupied
by Sphere, $R_s$, and the subregion of $R_s$, $r$, obtained by subtracting $R_s$’s center point.

Consider some part of Sphere that exactly occupies $r$; call it ‘SphereMinus’.

SphereMinus is a part of Sphere; Sphere is not a part of SphereMinus. So, by WS, there is some material object that is a part of Sphere but does not overlap SphereMinus. Given the ban on co-location, this object must exactly occupy the center point of $R_s$. So there are proper parts of material objects (themselves material objects) that are of zero measure in at least one spatial dimension.

**Version 2:** Consider Sphere and $R_s$ once again. Call the disc-shaped region whose perimeter is Sphere’s equator ‘$r_D$’ and call its exact occupant ‘Disc’. Subtract $r_D$ from the northern hemisphere of $R_s$ and call the exact occupant of the resultant region ‘Northerner’. Subtract $r_D$ from the southern hemisphere of $R_s$ and call the exact occupant of the resultant region ‘Southerner’. Now suppose that Northerner and Southerner are both parts of Sphere. Call the fusion of Northerner and Southerner ‘Almost-A-Sphere’.

Almost-A-Sphere is a part of Sphere; Sphere is not a part of Almost-A-Sphere. So, by WS, there is some material object that is a part of Sphere but that does not overlap Almost-A-Sphere. Given the ban on co-location, it is clear that Disc is just such an object. But Disc is two-dimensional, so there are proper parts of material objects (themselves material objects) that are of zero measure in at least one spatial dimension.

The idea behind replacing TPP with TPP* is to block version 1. An important premise in version 1 is that Sphere is not a part of SphereMinus. Given classical mereology, this follows from the claim, implicit in version 1, that SphereMinus is a proper part of Sphere. And, indeed, SphereMinus meets the TPP criteria for being a
proper part of Sphere. But it does not meet the TPP* criteria. To see this, plug in ‘Sphere’ for occurrences of the material object variable (‘x’) in TPP* and plug in tokens of a name of the region exactly occupied by SphereMinus for occurrences of the first subregion variable (‘r1’). Notice that the region thereby most eligible to have its name plugged in for occurrences of ‘r2’ is the point-sized region at the center of Rs. But this region, most eligible though it may be, still fails to play the r2 role since, qua zero-dimensional, it fails clause (ii) of TPP*. Since there is no further evidence for the claim that Sphere is not a part of SphereMinus, version 1 relies on an unsupported implicit premise when viewed under the lens of TPP*.

Version 2 is intended to go through even against the T-theorist who is equipped with TPP*. Since the region exactly occupied by Northerner (or Southerner, respectively) is both (i) extended in all spatial dimensions and (ii) such that its union with the distinct region exactly occupied by the fusion of Southerner (Northerner) and Disc is Rs, all TPP* criteria for Northerner’s (Southerner’s) being a proper part of Sphere are met. It would seem that this result is supposed to make version 2 a more serious threat to the T-theorist than is version 1 since, while the T-theorist (when equipped with TPP*) has reason to doubt that SphereMinus is a proper part of Sphere, she cannot plausibly deny that Northerner and Southerner are legitimate proper parts of Sphere.

However, the T-theorist’s inability to make the aforementioned denial is irrelevant. The relevant premise in version 2 is that Sphere is not a part of Almost-a-Sphere—not that Almost-a-Sphere is a part of Sphere or that Northerner and Southerner are proper parts of Sphere. The principal reason for accepting this premise seems to be that Almost-a-Sphere is a proper part of Sphere. However, as in version 1, the T-theorist
who is equipped with TPP* has ground to deny this claim. One can substitute ‘Sphere’
for occurrences of ‘x’ and substitute tokens of a name for the region exactly occupied by
Almost-a-Sphere for occurrences of ‘r’. Since the only region thereby eligible to play the
r role is the two-dimensional rD, there again is failure to satisfy clause (ii) of TPP*.

The result is that neither version 1 nor version 2 of Hudson’s anti-T-theory line is
a decisive threat to T-theory plus TPP*. A general diagnosis can be made. In both
versions, the WS argument only goes through if CTPP is presupposed. For without
CTPP, one cannot conclude that SphereMinus and Almost-a-Sphere are proper parts of
Sphere. Since no independent argument for CTPP is given, the WS argument is
uncompelling.

5. Parts and Exact Occupation

“Not so fast,” the anti-T-theorist might object, “there is indeed independent evidence for
the claim that Sphere is not a part of SphereMinus, namely, the following mereological
principle:

(Parts): x is a part of y just in case the region exactly occupied by x is included in the
region exactly occupied by y.

Since Sphere’s region is not included in SphereMinus’s, (Parts) shows that Sphere is not
a part of SphereMinus. Similar reasoning applies for Almost-a-Sphere.”

Like WS, (Parts) is a widely accepted and intuitively attractive principle.
Fortunately, the T-theorist need not reject it. It will be argued presently that there is a
plausible TPP*-friendly alternative formulation of (Parts) that has the same basic mereological content as the more familiar version. If this is so, then to interpret (Parts) in the way required in order to infer from it that Sphere is not a part of SphereMinus is less than compelling. The TPP*-friendly formulation uses existential quantification in place of definite descriptions.

(Parts*): \( x \) is a part of \( y \) just in case there is some region \( r_x \) which \( x \) exactly occupies and some region \( r_y \) which \( y \) exactly occupies, and \( r_y \) includes \( r_x \).

While the definite descriptions in (Parts) imply that \( x \) and \( y \) each exactly occupy exactly one region, (Parts*) leaves open the question of how many regions a given object may exactly occupy. This difference is unimportant for the anti-T-theorist, who assumes that every material object exactly occupies a single region. But the T-theorist need not endorse this assumption. Indeed, it will be argued below that the T-theorist ought to hold that a given material object in a pointy spacetime exactly occupies more than one region, so long as no two regions from among the regions it exactly occupies have a difference of positive volume.\(^{12}\) Call this thesis ‘multi-regional exact occupation’.

To more precisely understand multi-regional exact occupation for some material object \( x \), begin by considering a region \( R \) such that the traditional understanding of exact occupation tells us that \( x \) exactly occupies \( R \). Now consider the class \( C \) of regions \( \{R_0, \ldots, R_n\} \) such that (i) each \( R_i \in C \) is less-than-three-dimensional and (ii) every subregion of each \( R_i \) is at zero distance from some subregion of \( R \).\(^{13}\) Multi-regional exact
occupation says that \( x \) not only exactly occupies \( R \); it also exactly occupies every region that results from taking \( R \) and adding or subtracting any member of \( C \).

Given multi-regional exact occupation, it does not follow from (Parts\(^*\)) that Sphere is not a part of SphereMinus. For multi-regional exact occupation secures that there is at least one region (indeed infinitely many) that Sphere and SphereMinus both exactly occupy. Since any region is included in itself, (Parts\(^*\)) secures that Sphere is a part of SphereMinus.

6. Defending Multi-Regional Exact Occupation

Before concluding, two worries for multi-regional exact occupation should be discharged. First, one might worry that it is inconsistent with an important principle of extensional mereology. According to this principle, known commonly as ‘anti-symmetry’, if \( x \) and \( y \) are distinct and \( x \) is a part of \( y \) then \( y \) is not a part of \( x \). Consider again Sphere and SphereMinus. Now, the point of introducing (Parts\(^*\)) is that—unlike (Parts) as typically interpreted—it allows that Sphere is a part of SphereMinus. But, the worry goes, SphereMinus was introduced as exactly occupying a region that is included in, but does not include, the region that Sphere was introduced as exactly occupying. Presumably, then, Sphere and SphereMinus were introduced as being two entities. Yet if they are indeed two then they cannot both be parts of each other without violating anti-symmetry.

The answer to this worry is straightforward. The fact that the denotations of ‘Sphere’ and ‘SphereMinus’ were fixed via conceptually distinct descriptions does not entail that they name numerically distinct objects. The theorist who endorses multi-regional exact occupation is free to hold instead that the two names pick out a single
object under different descriptions. One of the descriptions highlights one of the regions that the object exactly occupies while the other description highlights a distinct region that the object exactly occupies. Anti-symmetry is upheld.

The second worry for multi-regional exact occupation is that it entails the counterintuitive claim that no two material objects $x$ and $y$ can be at zero distance from each other unless $x$ exactly occupies some region that overlaps some region that $y$ exactly occupies. To see this, suppose that $x$ exactly occupies some region $r_1$ and $y$ exactly occupies some region $r_2$ ($r_1 \neq r_2$). Either $r_1$ and $r_2$ are connected or not. If they are, this will be because where they are connected one is open and the other closed. Suppose then that, where they are connected, $r_1$ is open and $r_2$ is closed. Ex hypothesi, $x$ exactly occupies $r_1$; but from multi-regional exact occupation and the stipulation that $r_1$ exactly touches some boundary points of $r_2$ (call the region composed of these boundary points of $r_2$ ‘$r_3$’), it follows that $x$ exactly occupies some region $r_4$, which is the union of $r_1$ and $r_3$. But $y$ also exactly occupies a region that has $r_3$ as a subregion, namely, $r_2$. So, if $r_1$ and $r_2$ are connected then $x$ and $y$ must exactly occupy overlapping regions. Suppose then that $r_1$ and $r_2$ are disconnected. Since $x$ and $y$ are at zero distance from one another, it must be the case that at least one of the regions responsible for $r_1$ and $r_2$ being disconnected, call it ‘$r_5$’, is itself no greater than two-dimensional. Suppose for simplicity that $r_5$ is such that each of its parts is at zero distance from both $r_1$ and $r_2$. From multi-regional exact occupation and the fact that $r_5$ is (i) less than three-dimensional and (ii) such that each of its parts is at zero distance from both $r_1$ and $r_2$, it may be inferred that $x$ exactly occupies some region $r_6$ that is the union of $r_1$ and $r_5$ and that $y$ exactly occupies some region $r_7$ that is the union of $r_2$ and $r_5$. Since $r_6$ and $r_7$ overlap by having $r_5$ in common, it follows that $x$
and \( y \) exactly occupy overlapping regions. The T-theorist, it seems, is forced to hold that the smallest distance relation that any two material objects can bear to one another without “overlapping” in the sense described is non-zero.

Unlike the first worry, this one is not easy to explain away. The best the defender of multi-regional exact occupation can do is to emphasize that the “overlapping” at issue is not material part-sharing. The overlapping required involves only part-sharing for regions: \( r_4 \) and \( r_2 \) have \( r_3 \) in common and \( r_6 \) and \( r_7 \) have \( r_5 \) in common. Moreover, no part of either \( x \) or \( y \) exactly occupies (even in the traditional sense) either of \( r_3 \) or \( r_5 \). With the “overlapping” result thus downplayed, it seems insufficient for deciding the debate over T-theory.

7. Conclusion

Even if the worries in the preceding section do not sink multi-regional exact occupation, it is easy to imagine the anti-T-theorist sounding the following complaint. “Look, you have done nothing to convince me that T-theory is any more plausible than I thought it was at the outset. You’ve merely reshaped the discussion in a superficial way. Instead of the T-theorist having a view that does not sit well with one widely accepted principle, WS, she now has a view that does not sit well with some other widely accepted principle, mono-regional exact occupation.” But this complaint is overstated. The reshaping, far from being superficial, has fallen out of a more specific and sophisticated characterization of T-theory than Hudson considers, namely, a characterization whereby T-theory does sit well with WS and (Parts). The original problem for T-theory raised in Hudson’s version 1 is that T-theory leads to trouble given a principle, WS, which the T-
Theorist herself ought to endorse. The present reshaping shows that the putative trouble does not follow if the T-theorist rejects mono-regional exact occupation. This result is not superficial so long as there is no independently compelling argument showing that the T-theorist ought to accept mono-regional exact occupation.

Finally, the advertised return to gunk. The application of multi-regional exact occupation to the T-gunk reading of (Optional) is straightforward. Any T-gunky object in a pointy spacetime will exactly occupy whichever region R mono-regional exact occupation prescribes plus any regions that result from taking R and adding or subtracting any zero-volume region whose parts are all at zero distance from R. (Parts*) then secures that no T-gunky object will be equi-voluminous to any of its proper parts. Since no T-gunky object will be equi-voluminous to any of its proper parts, no application of WS to any T-gunky object will yield a zero-volume part.

To invoke the going metaphor in the literature, the move to multi-regional exact occupation asks one to put on “blurry goggles” with respect to the relation of exact occupation among pointy regions and T-gunky objects. However, unlike other ways of attempting to reconcile (Gunk) with the conceptual requirements of standard physics (e.g. Frank Arntzenius’s measure theoretic approach), the present suggestion does not ask one to “blur” any intrinsic properties of spacetime itself, whether topological, mereological, or metrical. Rather, it asks one to “blur” the external relation of exact occupation. While there are some drawbacks to the approach, it has the unique advantage of protecting the most interesting way of reading (Optional) from the threat of the WS argument.
References


1Lewis 1991. Following orthodoxy, ‘gunk’ at times will be used as a mass noun. The dialectic with which this essay is concerned presupposes spacetime substantivalism, the thesis that spacetime is a substance irreducible to distance relations. The dialectic also rejects material co-location and extended simples. It will be assumed throughout that all parts of material objects are material objects and that all parts of regions are regions. Non-gunky spacetimes are to be understood exclusively as “pointy” spacetimes, that is, as continuous manifolds of infinitely many zero-dimensional spatiotemporal atoms.


4 Hudson calls weak supplementation ‘the Remainder Principle’. Mereological and topological technical terms like ‘overlap’ and ‘connected’ will be used in the way now largely standard in the literature. See Simons 1987 and Cartwright 1987.

5 Interestingly, Hudson defends a version of multi-regional exact occupation in his 2001 as a response to the Problem of the Many. The author became aware of Hudson’s version of multi-regional exact occupation only after having developed the version presented here.

6 The ‘T’ in ‘T-theory’ abbreviates ‘three’, as in (at least) three dimensions. The terminology is Hudson’s. The T-theorist denies that material objects possibly exist in spacetimes with fewer than three spatial dimensions.
Hudson (2002, 2005) explicitly registers the assumption that gunk is impossible, referring readers to his 2001 for arguments. Accordingly, it is not strictly correct to say that his argument against T-theory concerns a completely arbitrary three-dimensional object; rather, it concerns an arbitrary non-gunky three-dimensional object. However, what matters for present purposes is that his argument does not presuppose that the three-dimensional object it concerns has any less-than-three-dimensional parts (lest it beg the question against T-theory). Since the T-gunk theorist will not share Hudson’s assumption that gunk is impossible, her view is open to Hudson’s form of argument.

The parts yielded by this metaphorical mechanism may remain undetached from the relevant whole. Metaphorical “chopping” does not entail literal division.

Some philosophers go so far as to hold that it is incoherent to deny that like subregions of the region exactly occupied by a material object might differ as to whether they exactly contain proper parts of that object. See Hofweber and Velleman Forthcoming.

Hudson 2005, p. 54.

Notice that TPP* entails TPP.

There is one small modification to TPP* that is required in order for it to accord with multi-regional exact occupation, but it is not a modification that affects TPP*’s role in furnishing a way around the WS argument. The modification is to clause (iii). It will be shown below that the friend of multi-regional exact occupation must allow for a certain kind of overlap between $r_1$ and $r_2$; what she cannot allow is for the intersection of $r_1$ and $r_2$ to have positive volume. So the modified version of clause (iii) would read: ‘$r_1$ and $r_2$ do not have an intersection of positive volume’.

I suspect it may be provable, given the going ban on co-location, that clause (ii) renders
clause (i) redundant. Nevertheless, this seems to be a case where redundancy helps rather than hinders exposition.

14 Also, as mentioned in an earlier note, this form of overlap requires a minor modification to clause (iii) of TPP*.

15 Arntzenius 2003.