

## IMMATERIAL BEINGS

### *1. Introduction*

Holes seem to present something of a metaphysical problem. For in some good sense they seem to be essentially absences: holes are where things are not. Buying into something like that conception has led metaphysicians to see the problem of holes as highly domain specific and largely independent of more general issues regarding the metaphysics of paradigm material objects and of space-time. That, in turn, has led many metaphysicians to ignore the problem of holes altogether (is worrying about holes really engaging in proper and worthy metaphysics?) and has polarized remaining metaphysicians into those who endorse what I will call an *inflationary* theory of holes, and those who endorse what I will call a *deflationary* theory. For once we conceptualize holes in terms of absences, two opposite positions naturally present themselves. On the one hand there are those who hold that folk intuitions are basically right about holes: holes exist roughly where we think they do. Thus in the relevant region there exists some entity<sup>1</sup> which is a hole. But since holes are absences, the entity in question cannot be an ordinary material one: it must be a special kind of entity. Hence the idea of immaterial beings<sup>2</sup> is born. This view might, perhaps uncharitably, be thought of as one in which we reify absences: absences are real entities; they are immaterial beings. Views of this kind are inflationary. The advantage of inflationary views is that we get to say that roughly speaking, the folk are right about the location and number of holes in the world. The disadvantage is that it requires an account of immaterial beings. Those who find the idea of immaterial beings and the reification of absences objectionable, instead embrace some sort of deflationary view according to which holes are identified with proper parts or surfaces of paradigm material objects<sup>3</sup>. The advantage of these views is that no recherché metaphysics of immaterial beings is necessary. The disadvantage is that it does serious damage to many of our folk intuitions about holes.

This paper defends a view that falls somewhere between the two extremes of inflationary and deflationary accounts, and it does so by rejecting the initial conceptualization of holes in terms of absences. Once we move away from this conception, I argue, we can see that there are no special metaphysical problems associated with holes. Rather, whatever one's preferred metaphysics of para-

digm material objects, that account can equally be applied to holes. This means that like the deflationist, I am *entity monist*: I reject the idea that there are any immaterial beings. On the other hand, like the inflationist I reject the idea that we should identify holes with parts or surfaces of paradigm objects. Like the inflationist, I hold that there exist entities in roughly the regions of space-time where pre-theoretically we would say there exist holes, and those entities *are* holes. Call this latter part of the view—that where the folk are apt to claim there is a hole, that hole has roughly the dimensions that the folk attribute to it—*hole-instinctivism* (the view that our instincts about hole location/dimension are roughly right). Ultimately I embrace *hole conventionalism*, a view that includes commitment to both entity monism and hole-instinctivism. According to hole conventionalism, holes are no more ontologically problematic than statues, nor are they of a fundamentally different ontological kind from statues.

This means that in a very strong sense there is no domain specific problem of holes. This is not just the (I take it true) claim that within metaphysics, apparent domain specificity dissolves once we see that no claim exists in a vacuum: when we commit to one view we thereby commit to a whole package of other views. It is rather the stronger claim that there is not even apparent domain specificity, for there is no special ‘hole problem’.

There must be reasons, however, why many are drawn to hole deflationism. In section 2, I consider some reasons why we might be suspicious of the idea that there exist entities just where we think there exist holes. These worries are often expressed as doubts about the coherence of the notion of immaterial beings, and it is easy to see why, if one assumes that hole-instinctivism entails that holes are immaterial beings. Though I deny this entailment, many of the arguments against thinking of holes as immaterial beings are equally good, or, as I argue, bad arguments against hole-instinctivism. Thus, section 2 is devoted to defending hole-instinctivism, and with it, one of the central contentions of an inflationary account. In section 3 I turn to consider whether the other crucial claim of inflationary accounts, namely that there is a viable distinction to be drawn between material and immaterial beings, can be sustained. I argue that it cannot. Finally, in section 4 I draw together the threads of the account of hole conventionalism that have emerged throughout the previous two sections and add some meat to the bones of the account. I argue that this account not only steers a plausible path between inflationary and deflationary accounts, preserving the best of both, but importantly, it also allows us to treat holes as being on a par with any other entity.

## 2. *Of Respectable Entities*

There are a number of different theories of holes that can be broadly categorized as either inflationary or deflationary. The most carefully constructed inflationary

theory is that of Casati and Varzi, according to which holes are a sub-class of immaterial being. Though Casati and Varzi do not provide a general account of immaterial beings, it is clear that whatever else they are, they are beings that occupy regions of space-time. Holes then, are immaterial beings with a certain topology and ontological dependence—they ontologically depend on hole-hosts: material beings. As Casati and Varzi put it, holes are immaterial beings “‘growing’ parasitically, like negative mushrooms, at the surfaces of material beings”.<sup>4</sup> One might also think of Hoffman and Richards’ proposal as an inflationary one.<sup>5</sup> Their primary interest lies in explicating how it is that we recognize shapes, and to that end they are interested in objects and their parts. But they raise the idea that objects might have both positive and negative parts, with holes being negative parts of objects.<sup>6</sup> It is not entirely clear what this proposal amounts to, at least at the metaphysical level. Hoffman and Richards go to some lengths to define parthood in terms of topology, but those details are not relevant here. The real questions pertain to the *nature* of those parts. It is clear that positive parts are material objects (or at least, we can all agree that they are material, and that they are at least potential objects). But what is the nature of negative parts? Assuming that the distinction between positive and negative parts tracks some metaphysical difference, it is plausible that the latter are immaterial beings. In that case Hoffman and Richards’ view can be seen as a variant of Casati and Varzi’s view. Both agree that holes are immaterial beings, the difference between the proposals lies in how holes are related to their material hole-hosts. For Casati and Varzi, holes are not parts of material objects. Rather, they suggest that they are parts of some larger immaterial being that is the complement of the material object or objects in question. I return to this issue later. For now, we need only note that on a plausible reading of Hoffman and Richards, their view, like Casati and Varzi’s is a paradigm example of an inflationary account of holes.

Arguably however, deflationary accounts are in the majority. Some of these are so deflationary as to be eliminativist. Frank Jackson, for instance, holds that there are no holes, but sentences that appear to quantify over holes can be paraphrased into sentences about hole-linings and hole surrounds, even though these material beings are not themselves holes.<sup>7</sup> Lewis’ account is a paradigm example of deflationism. The Lewises identify holes with material hole-linings.<sup>8</sup> Thus holes are perfectly respectable material beings. But hole-instinctivism is false: holes do not exist where we think they do, nor have a good many of the properties to which we attribute them. Of course, there are numerous variations to this sort of deflationism: one could identify holes not just with the hole lining, but with the lining of the entire material hole-host, or with the hole-lining and the material host itself, or with the hole-lining and some proper parts of the material hole-host. These are all variations on a theme, a deflationary theme that aims to identify holes with some part or surface of paradigm material objects. Deflation-

ary accounts, therefore, deny not only that holes are immaterial beings, they also deny hole-instinctivism.

But what it is about holes that pushes many towards endorsing a deflationary account? After all, in general eliminativist or severely deflationary theories are in the minority, and are arrived at more as a last resort (the conclusion to an argument the premises of which one is firmly wedded) than a first option. One assumes that in this case deflationists have the uneasy feeling that if hole-instinctivism was right, then holes would somehow turn out not to be metaphysically respectable entities. But why?

In what follows I consider a number of reasons for being suspicious of hole-instinctivism, reasons that can all in some way be explained or motivated by mistakenly conceiving of holes as absences. These reasons, or their close cousins, are usually thought of as arguments against inflationary accounts, and insofar as inflationary accounts are committed to hole-instinctivism, they are. But since hole-instinctivism is a weaker thesis than are any of the inflationary accounts, and since my view is committed only to this weaker thesis, it will be instructive to consider these arguments in the light of this weaker claim.

First an aside. It might seem that I have reversed the usual order of proceedings by considering objections to a view before presenting said view. Undeniably so. The reason I approach matters in this order is twofold. First, if hole-instinctivism cannot even get off the ground, then there is little point considering any view committed to it. Second, and more importantly, recall that hole conventionalism is largely a meta-view: it is the view that holes should be treated analogously to paradigm material objects. The exact details of that view depend on one's account of paradigm material objects (is one a three- or four-dimensionalist; does one think that objects occupy or are identical to space-time regions, does one endorse a counterpart or identity account of modality and so forth). Since likely we are all familiar with at least the broad brushstrokes of the different accounts of paradigm material objects, there is little point me rehearsing the details at this stage. Rather, we should focus on reasons we might have to suppose that holes *cannot* be treated analogously to paradigm material objects. Once we establish that there are no such reasons, then in most cases we can safely leave it to the individual to fill in the details of their own preferred account. Having said that, I do try to sketch something of the broad features of this account as we proceed to section 4.

### *2.1 Ontological Dependence*

One reason we might have to be suspicious of hole-instinctivism is that it seems to entail that holes are ontologically dependent on other entities. Where there go paradigm material objects, there sometimes go holes. Holes *sans* material objects there ain't. Holes, it seems, are logically dependent on material objects: for

every world in which there is a hole, is a world in which there is some material object that hosts that hole.<sup>9</sup>

Framing the issue in this way makes perfect sense if at bottom one conceives of holes as absences. For while a presence can straightforwardly be thought of as an ontologically independent entity, an absence would seem, by definition, to be logically dependent on some other entity: an absence must be an absence of something, or an absence relative to something. But this would seem to be a worrying sort of ontological dependence if one understands absences as presences of some sort of entity (an immaterial being, say). On the other hand, if holes just *are* paradigm material objects or parts or surfaces thereof as deflationary accounts hold, then it makes perfect sense that there can be no holes without material objects.

The real issue is whether hole-instinctivism entails an asymmetry in ontological dependence between holes, on the one hand, and paradigm material beings on the other. Casati and Varzi's view is that the property of *having* a hole is an accidental property of a material object that hosts the hole. Hence one and the same (material) individual can survive the loss of a hole. A doughnut can survive losing a hole, though we may no longer refer to it as a doughnut, just as a woman can survive the loss of all her siblings, though we will no longer refer to her as a sister. If an individual is a hole, however, then that individual is *essentially* a hole. Since we are apt to say that something ceases to be a hole if it has no hole-host, it follows that there is an asymmetry in the direction of ontological dependence of holes upon hosts.

While something about the inter-dependence of holes upon hosts is clearly right, it is not clear why the hole-instinctivist should accept quite this picture. For this picture introduces the asymmetry right at the beginning, by holding that doughnuts, for instance, are accidentally doughnuts, but holes are essentially holes. Without getting too far into the domain of accidental and essential properties, it seems that the hole-instinctivist has two live options. One is to hold that holes are not essentially holes. Just as we can say that one and the same material individual persists through the loss of its hole (hence ceasing to be a doughnut), so too we can say that one and the same individual persists through the loss of its hole-host (hence ceasing to be a hole). Hole-instinctivism is the thesis that some entity, a hole, exists in the region where we would pre-theoretically tend to say that a hole exists. That entity might be immaterial (if an inflationary theory is true) or material (if entity monism is true). *Prima facie* there is no reason to suppose that just because a region contains a hole, that region would fail to contain the very same individual if there were no hole-host. The entity in question would not, under those circumstances, be a hole, but that just tells us that being a hole is not an essential property of individuals, a claim that hole-instinctivists need not deny. Indeed, the idea that being a *hole* is not an essential property

seems no more implausible than the idea that being a *doughnut* is not an essential property (as compared to the idea that being a sister is not an essential property). If an individual can persist despite no longer being a doughnut, then it is not clear why an individual should not persist despite no longer being a hole.

The alternative is to hold that being a hole is an essential property of individuals. But in that case there seem equally good grounds for thinking that properties such as ‘being a shoe’ or ‘being a doughnut’ are essential. But then although holes have essential properties that are relational—properties that depend on their hole-hosts—the same is true for paradigm material objects. A shoe is a shoe only if it has a hole for a foot. A statue is a statue only if it has the appropriate sort of surrounds. A block of marble does not contain a statue, even though there is some statue-shaped object within the block. A ten dollar note is a ten dollar note only if a whole bunch of other entities exist and conventions hold (reserve banks, currency conventions and so forth). In general, paradigm material objects are the objects they are in part in virtue of their extrinsic properties: in virtue of the nature of their surrounds. So in this respect, they are no different to holes: both have relational properties that are essential. In order to create an asymmetry, we need to suppose ‘hole’ designates a quite different kind of property to ‘statue’, and it is not clear why we should do that.

## 2.2 Holes, Space-time and Stuff

Another worry that is at least part undergirded by the notion of holes as absences, is that if hole-instinctivism is true then there is nothing satisfying with which we can identify holes. After all, with what can one identify an absence? More specifically, the deflationist’s thought, I take it, is that if we could identify holes with something respectable, then they could safely be admitted into our ontology. Since they cannot be so identified, they should instead be identified with some parts or surfaces of paradigm material objects. Hence we should reject hole-instinctivism. But, as we shall see, this issue is surely a red herring.

Space-time regions are one plausible candidate to be the respectable entities with which we identify holes. Even inflationists such as Casati and Varzi, however, are prepared to concede that we cannot identify holes with regions of space-time, on the grounds that holes can move around.<sup>10</sup> More than that, I imagine, one might suppose that a hole could have existed at a different space-time location than the one at which it in fact exists. Whatever the strength of these two arguments, they are certainly no stronger than the ones against identifying paradigm material objects with regions of space-time. Clearly three-dimensionalists about persistence cannot identify any persisting entity with the region of space-time at which it exists. Three-dimensionalists hold that each three-dimensional slice of a persisting object is strictly identical to every other three-dimensional slice of the same object. Since no two three-dimensional

space-time regions are strictly identical, three-dimensional objects are not identical to the space-time regions at which they exist. That is true regardless of whether the entities in question are paradigm material objects like statues, or entities like holes. On the other hand, we *can* identify four-dimensional objects with space-time regions, and we can do so despite the fact that they move about. We simply say that any four-dimensional object is identical to some four-dimensional region of space-time. Then there is nothing to stop us thinking of holes as four-dimensional entities that are identical to four-dimensional regions of space-time: and that is so regardless of whether we think holes are immaterial beings, or are material beings but not *paradigm* material beings. So the fact that holes can move is no more reason to deny the identity claim, than is the fact that paradigm material objects move. Indeed, the fact that either of them moves is *no reason at all* to deny the identity claim so long as one is a four-dimensionalist about persistence.

That it is contingent that material objects and holes exist at the regions that they do, seems a far stronger reason to reject the putative identity of entities with regions. However, there are those who are unmoved by such considerations. Perhaps they deny that paradigm material objects have the various modal properties we tend to ascribe to them.<sup>11</sup> Perhaps they avail themselves of some sort of counterpart theory, thereby maintaining that objects are contingently identical to space-time regions. Hence under one counterpart relation—the space-time region counterpart relation—an object has one set of counterparts all of which exist at the same place and time—and under another counterpart relation—the statue counterpart relation, say—that same object has a different set of counterparts, namely a bunch of statues that exist at different times and places in different worlds.<sup>12</sup> Whatever one makes of that view, it is an equally plausible view about holes. Holes, we might say, are contingently identical to space-time regions: holes will have hole-counterparts and space-time region counterparts. Some of the latter will not be holes, just as some of the space-time region counterparts of the statue will not be statues. The point is, there is no reason to find holes any more problematic in this respect, than one finds paradigm material objects. So if holes are ontologically suspicious because they *cannot* be identified with regions of space-time, then so too are paradigm material objects. And if paradigm material objects are ontologically respectable because they *can* be identified with space-time regions, then so too are holes.

Arguably though, most of us think that paradigm material objects are perfectly respectable even though we do not think that they are identical to any region of space-time. Perhaps then, the worry is that if we cannot identify holes with space-time regions, then we must identify them with something else. Paradigm material objects can be identified with the ‘agglomeration’—the mereological fusion, set, plurality or whatever—of material stuff in some region. Or,

in the case of many three-dimensionalist theories, paradigm material objects are related by the constitution relation to different fusions, sets or pluralities of stuff at different times. Casati and Varzi maintain that we cannot identify holes with stuff, because holes can survive the loss and replacement of such stuff (and, one might imagine, because a hole could have been composed of different stuff).<sup>13</sup> These worries are analogous to those raised with respect to identifying holes with space-time regions. If one chooses to identify either holes or paradigm material objects with various portions of stuff, then one is pushed towards counterpart theory (since the same object might have been composed of different stuff) and pushed towards four-dimensionalism (if the objects are composed of different portions of stuff at different times). The point is that the very same challenges arise whether one is talking about identifying holes with portions of stuff, or identifying paradigm material objects with portions of stuff. For those who think that these challenges cannot be met, recourse is needed to a metaphysics that invokes some sort of constitution relation. But in the same way that we can say that paradigm material objects are constituted by different portions of stuff at different times, so too we can say that holes are constituted by different portions of stuff at different times. Whatever one's preferred way of thinking about paradigm material objects across time and worlds, the very same account can be employed with respect to holes. At least, it can be employed just so long as it makes sense to think of holes as being identical to, or constituted by, portions of stuff. And that, one might say, is precisely what does not make sense since holes are essentially *absences* of stuff. It is not simply that holes could have been filled with different stuff, or are filled with different stuff at different times: rather, it is that holes need not be filled with stuff at all.<sup>14</sup> But if holes are absences, how can they have any properties at all, even dispositional properties? This is the problem that Casati and Varzi face given that they reject identifying holes with space-time regions or with portions of stuff (and, I take it, reject the idea that holes are constituted by portions of stuff at times).

In the following section I consider, in the light of current science, Casati and Varzi's proposal to solve this problem by appealing to the idea of a fabric of space. While the basics of this proposal are, I conclude, defensible, careful consideration reveals two important things. First, it tells us that the idea of holes as absences, or at least, as reified absences, is deeply mistaken. And plausibly it is largely this mistake that is responsible for the division between inflationary and deflationary theories. Inflationary theorists think that in some way it makes sense to talk about entities that are absences, that is, to talk of absences as things. So inflationary theorists think that there exist immaterial beings. Deflationary theorists think that reifying absences is crazy, and thus they think that if there are any holes, they must be identical to some part of a paradigm material being. What we see, however, is that the conception of holes as absences is mis-



taken, and understanding this allows us to steer a middle ground between the two positions. Second, these considerations reveal why the distinction that inflationary theorists want to draw between material and immaterial beings is not only unnecessary, but also deeply problematic. There is simply no tenable way to cash out this distinction. Ultimately this is why we should be entity monists.

### *3. Material and Immaterial Beings*

What then, does the inflationary theorist say about the nature of holes qua immaterial beings, if immaterial beings are not regions of space-time, or portions of stuff? Casati and Varzi endorse the general idea of thinking of space itself as a sort of fabric. While they are at pains not to commit themselves to any particular account, this general strategy allows us to say something like the following. Both material and immaterial beings are made of space. Material objects are made of qualified space; immaterial beings are made of unqualified space.<sup>15</sup> Though the distinction is not explored in any detail, roughly, the idea is that unqualified space is bare space, while qualified space is space that is qualified with additional properties. So, for instance, what it is for there to be some matter is for some space to be qualified. Since it is a dispositional property of unqualified space that it can be qualified, we can explain how immaterial beings have dispositional properties, including the dispositional property to be fillable.

The distinction between qualified and unqualified space is important to Casati and Varzi's account, not only because it provides a way of explicating how holes can have properties, but also, I think, because it can be used to make sense of the distinction between material and immaterial beings.

#### *3.1 Material versus Immaterial*

At first blush, the distinction between material and immaterial beings seems straightforward. Not so. There are a number of distinctions in the vicinity, none of which are adequate. Here's one. Material beings are all and only the entities that a materialist admits into her ontology (where roughly, materialism is true of the actual world if it contains either only the sorts of properties currently found in our best science, or properties that are discovered by a completed science using current scientific methodology). Then in worlds where dualism is true, 'spooky' dualistic substances or properties are not material, and if parapsychology is true, ghosts and other spirits are not material. I take it this is not sense of 'material' at play here. Dualistic or parapsychological worlds are surely ones in which the dualistic or parapsychological substances or entities could have holes. Moreover, it is pretty clear that in the actual world, we do not think of holes as being scientifically spooky in the way that dualistic or parapsychological entities are. They may be metaphysically puzzling, but the existence of holes hardly

threatens anything one might plausibly call materialism. Here is another distinction: material beings are all and only the concrete entities with causal powers; immaterial beings are all and only the abstract entities that lack causal powers. Then numbers and platonic forms rightly come out as immaterial. But whatever they are, holes are not abstract entities: they exist in space-time. That cannot be right distinction.

A plausible way to cash out the distinction is to return to the idea of qualified and unqualified space. If we suppose that every world is made up of space of some sort, then we can say that material beings are ‘made of’ qualified space, while immaterial beings are ‘made of’ unqualified space. Then in worlds with ghosts, those ghosts count as material, since they are made of qualified space, while a hole in a ghost is immaterial, since it is made of unqualified space. Something like this is Casati and Varzi’s view. In fact, there are two views in the ballpark here. On one view, any region of space is either qualified or unqualified but not both: what it is to qualify some space is to make that space no longer unqualified. On this view, a region of space-time can be wholly occupied by either a material or an immaterial being, but not by both. Call this the exclusive account.<sup>16</sup> This is not Casati and Varzi’s view. Their view is perhaps best thought of not in terms of qualified and unqualified space, but in terms of basic space, and qualified space. Every region of space-time is occupied by basic space. Basic space is the fabric of space-time. Some of that fabric is, additionally, qualified by various other properties. This is consistent with Casati and Varzi’s minimal theory of immaterial beings, according to which for every material being, there is some coinciding immaterial being. Call this the inclusive account.<sup>17</sup> I return in section 4 to consider the exclusive and inclusive accounts more completely in the light of the hole conventionalist account. For now, what matters is that the inflationary account’s distinction between material and immaterial beings centers on a distinction between basic or unqualified space, and qualified space. But can any sense be made of that distinction. In the following section I argue that the answer to that question is ‘no’.

### 3.2 *The Fabric of Space*

Some aspects of Casati and Varzi’s proposal are, I think, plausible. While the Einstein-Minkowski view of space-time does not entail that there is a *fabric* of space-time, it is certainly suggestive of that view. Although Einsteinian relativity tells us that there is no absolute time or space against which, say, the acceleration of some object can be measured, there is absolute space-time. We *can* determine whether a bucket in an otherwise entirely empty universe is spinning or not, for the bucket will accelerate, (or not), relative to absolute space-time, and we can determine that by looking at the bucket’s trajectory through space-time. And if there is something relative to which the bucket accelerates, it is at

least plausible to think of that as the fabric of space-time. Another way of making sense of the idea of a fabric of space-time is in the context of string (or more properly, super-string) theory. According to string theory, space-time is composed of a bunch of interwoven vibrating energy strands. On this view, there is just one kind of fundamental entity—the string—and what it is for there to exist different fundamental particles is for different token strings to have different vibration patterns. Thus what it is for there to exist some material being in a region, is for that region to be occupied by strings with a particular set of vibrational patterns.

*Prima facie*, string theory seems ideally suited to the needs of the inflationary theory in providing a way to distinguish between qualified and unqualified space (or space-time) and hence between material and immaterial beings. It is tempting to think of a region of unqualified space or space-time as being composed of strings with no vibrational pattern, and qualified space or space-time in terms of strings with various different vibrational patterns. Then regions of space-time that are qualified are occupied by what we traditionally think of as material beings. Regions of space-time that are unqualified are what we might traditionally have thought of as empty regions. Since only strings with vibrational patterns have causal powers—different causal powers just *are* different vibrational patterns—these regions are causally inert. (Though *all* strings have dispositional powers since even non-vibrating strings have the dispositional power to vibrate, thus explaining how such a region has the disposition to be occupied by some material being). But, we might say, we were wrong to think that regions of space-time whose fabric is composed of non-vibrating strings are *empty* regions. Rather, they are occupied by immaterial beings, beings that lack causal powers but have dispositional powers, such as the dispositional power to be materially filled.

If that were an accurate picture of our world, then it would provide a clear mechanism for distinguishing material from immaterial beings. But it would also leave many questions unanswered. For one might accept the fundamentals of this picture yet deny that there exist any immaterial beings, insofar as it is open to someone to argue that what it *is* for a region of space-time to be empty, is for that region to be composed of only non-vibrating strings. A region is only occupied by some being if the fabric of that region has at least some causal powers, and some non-dispositional properties, and by definition, on this view all of *those* regions are occupied by *material* beings. Adjudicating that dispute brings us back to the issue of the extent to which it is independently plausible that there exist immaterial beings. But, as Casati and Varzi admit, if immaterial beings are causally inert it is a fair question to ask how we perceive, let alone interact with, such beings. Indeed, something like this worry is perhaps what lies behind the claim of David's Lewis' Argle that:

All things are material. Either holes are somehow material, or else there are no such things. Maybe a hole is the material hole-lining that, as we so misleadingly say, surrounds the hole; or else whatever ostensible reference we make to holes is secretly some other sort of language-game altogether, or it's fictitious reference, or it's just plain mistaken.

It is easy to be sympathetic with that view if we think of immaterial beings as occupying empty regions of causally inert space. So it is at least in some respects a good thing for the defender of immaterial beings that this is not, given what we know of current physics, a plausible view of our world. Modern physics tells us that there is no truly 'empty space' of this kind. If we distinguish matter from fields, (a distinction we can draw regardless of whether we embrace string theory or not) then there *are* regions of space that contain no matter particles. But there are no regions where the value of the fields is uniformly zero (even setting aside the fact that the Higgs field is at its lowest energy level at a non-zero value). Since the uncertainty principle tells us that we cannot know both the value of a field and its rate of change, we cannot know that the value of a field across some time and region is a uniform zero. Indeed, if a field has a value of zero across a region at a given moment, then its rate of change is random. So the value of any field through a region jumps around a zero value, but does not remain zero for more than a moment. What seems like empty space actually has constant energy fluctuations at the quantum level.

All this is to say that given 'standard' particle physics, there are no uniformly empty regions of space-time, and given string theory, there are no regions uniformly composed of non-vibrating strings. That is good news for the defender of hole-instinctivism. For regardless of whether holes are taken to be immaterial beings, if we think they are entities that occupy empty regions of space-time, then we have some good reasons to be hole eliminativists, or to reject hole-instinctivism in favor of some deflationary account. But if there are no empty regions of space-time, then on what basis do we deny that there exists some being in precisely the region where the folk would say that there exists a hole? One response might be to take umbrage at the use of the term 'being' or 'object' in this context. Friends of restricted composition might point out that just because there are a bunch of material particles in some location, does not entail that there is some composite object composed of those particles. In general, they might maintain, just because some region of space-time is occupied by 'stuff'<sup>18</sup> of some sort or other, does not mean that there exists any being or object that occupies that and only that region. While this is not my preferred view, it does not at any rate seem to provide a *general* argument against hole-instinctivism. It means that there is no guarantee that any being exists in the relevant 'hole' region, but it doesn't provide any particular reason to suppose that there isn't such a being. There might be such arguments. Perhaps only cer-

tain kinds of portions of stuff compose further beings: the sorts of portions that compose paradigm material objects. But that is unlikely. The remainder of this section argues that there is no viable material/immaterial distinction. And most of those arguments can equally be thought of as reasons why there could not be any non-arbitrary restriction regarding which portions of stuff compose entities and which do not, such that we can say that there exist entities where we would say there are paradigm material beings, but not where we would say there are holes. Absent some principled way of ruling in composition only in the case of paradigm material objects, there is no reason to reject hole-instinctivism.

Nevertheless, the push towards accepting hole-instinctivism is certainly stronger if one holds that every region of space-time occupied by some stuff, is wholly occupied by some entity—that is to say, every filled region of space-time is wholly occupied by some entity.<sup>19</sup> For then given what physics tells us about our world, it follows that there exists an entity in exactly the region where we are tempted to say there is a hole. And it seems natural to say that that entity *is* the hole, and thus that hole-instinctivism is true.

Notice too that the fact that there are no empty regions means that the problem we raised in section 2.2, namely being unable to identify holes with, (or hold that holes are constituted by) portions of stuff because there are no such portions of stuff in the relevant regions with which to do the identifying, ceases to be a problem.<sup>20</sup> There may be reasons not to identify either holes or paradigm material entities with portions of stuff, but those reasons do not include there being a lack of stuff to do the job in the case of the former but not the latter.

So the story physics tells us about regions of space-time makes plausible hole-instinctivism. But it makes a distinction between material and immaterial beings difficult to sustain. The problem is that there is no scientific distinction that tracks the notion of qualified versus unqualified space. We cannot make sense of the idea of qualified and unqualified space in terms of a distinction between regions whose fabric is uniformly composed of vibrating strings, versus regions whose fabric is uniformly composed of non-vibrating strings, since the latter do not exist. Nor can we understand it in terms of a distinction between regions of space where fields at that region are at a uniform non-zero value, and regions of space where fields at that region are at a uniform zero value, since the latter do not exist.

We might, then, be tempted to cash out the distinction between material and immaterial beings in terms of a distinction between matter and fields. We might say that material beings exist at space-time regions occupied by matter particles, while immaterial beings exist at space-time regions occupied only by fields. One minor worry with this idea is that it's not clear that there is any principled distinction between fields and matter once we realize that energy and mass are the same property. For then what it is for there to be some matter at a

location is for a particular field to have a high (energy) value at that location. Moreover, we know that just as every field is constituted by a particle of some kind—the gravitational field by gravitons, the electromagnetic field by photons and so forth—so too what we traditionally think of as matter particles—electrons, for instance—must also be understood both as probability waves and fields. (Electrons, for instance, are the constituent particles of the electron field). So the relevant distinction between matter and non-matter is not a distinction that is tracked by the particle/field distinction.

Now, none of that means that we cannot distinguish between the so-called matter particles and the ‘matter’ fields that they compose, and what I’ll call the non-matter field particles and the non-matter fields *they* compose. Then we are not distinguishing matter from fields, but rather, we are distinguishing different types of fields and their constituent particles, namely matter particles and fields, from non-matter fields and their constituent particles. Thus we could hold that material beings are composed of both matter and non-matter particles and fields, while immaterial beings are composed of only non-matter particles and fields.

The real worry about this distinction is that it pretty clearly fails to track any sort of *intuitive* distinction between material and immaterial beings. Consider a perfectly average hole in a paradigm material object on earth: a paradigm hole, if you will. No such paradigm hole exists in a region of space-time occupied by only non-matter particles and fields. So if what it is to be an immaterial object is to be composed only of non-matter particles, then the paradigm holes we find on earth are material, not immaterial beings. Indeed, it seems unlikely that in the actual world, any hole in a material object will ever be immaterial in the required sense, since any region of space-time that is contiguous with a material object is almost certain to be occupied by at least some matter particles.

Return to Argle’s words for a moment. All things are material, he claims. But what does he mean by that claim? Is this the substantive claim that although entities might have been composed of something other than matter, in fact in our world they are always composed of matter? Or is it the trivial claim that whatever in fact the actual entities are composed of, that stuff is matter? Or is it the semantic claim that of the totality of entities over which we quantify, only those entities composed of matter are rightly referred to as *things* or *objects*. That is, is it the claim that by things, we intend to refer to only a sub-set of all the entities, namely the material entities.

This last semantic claim is irrelevant to the issue at hand. Even if it is true that the semantics of ‘object’ or ‘thing’ are such that they refer to only the subset of entities that are material, the real issue is whether that subset is a *proper* subset. The issue is whether there *are* any immaterial entities, not whether we would be right or wrong to call those entities objects. The second reading is not a very interesting one. If matter is just *whatever* it is that fills the space-time

regions in the actual world, then it is trivially true that there are no immaterial beings, but it might still be that there are two fundamentally different kinds of material beings, one of which includes the paradigm material beings, and one of which includes holes and other entities of that ilk. Perhaps then, the claim is intended as a substantive one. There are two readings of that claim. The first is the substantive claim that there are no beings that are sufficiently good deservers of our folk term ‘immaterial beings’. The second is the substantive claim that there are no beings that are sufficiently good deservers of some pseudo-scientific term ‘immaterial beings’. Given what we have said so far, there is good reason to suppose that the first claim is true. Suppose the folk concept of ‘immaterial being’ contains at least two clauses, such that there are immaterial beings only if there are beings that roughly speaking have the properties we associate with them (they exist roughly where we think they do, they are penetrable to paradigm material beings and so forth) and there is some natural kind distinction (to be discovered by science) that underlies the distinction between material and immaterial beings. (It is plausible, I think, that the folk concept should in part defer to the natural sciences). Since there is no natural kind distinction that also tracks our intuitive distinction, we should be eliminativists about immaterial beings. It is this sense in which I am an entity monist. There are no immaterial beings, there are only material beings, and some proper sub-set of those are the paradigm material beings that we generally refer to and quantify over.

Now, there is the second sense of this claim. That is the claim that there is no scientific distinction that we can draw between material and immaterial beings, regardless of whether that distinction tracks anything that pre-theoretically we might have thought of as material or immaterial. As we have seen, there is some distinction that we can draw: the distinction between regions of space-time that contain matter particles (and fields) and those that contain only non-matter particles (and fields). It is an open question whether that distinction is a scientifically interesting one. If it is, then there is perhaps a sense in which there are material and immaterial beings. But not the relevant sense in which we want to talk of holes and things of that ilk as being immaterial beings.

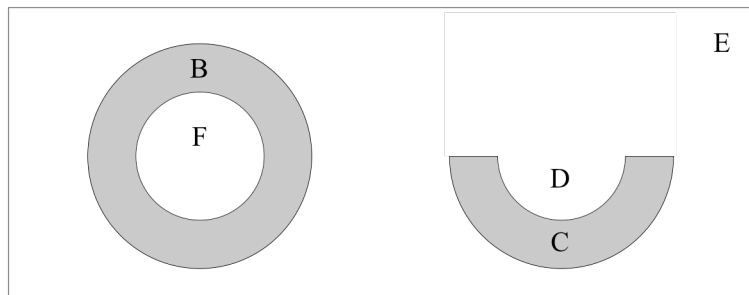
So there is good reason to reject any interesting philosophical distinction between material and immaterial beings, and instead to adopt entity monism. There is also good reason to endorse hole-instinctivism: there really do exist entities in just the regions where we suppose there to be holes. Hence a view that combines monism and hole-instinctivism seems plausible. That view is hole conventionalism.

#### *4. Hole Conventionalism*

Holes conventionalism is the view that there is nothing special about holes: holes are not a particular sort of a particular kind of fundamental entity—a par-

ticular kind of immaterial being. Rather, whatever the broad outlines of the story we tell about paradigm material objects, that same story can be appealed to with respect to holes. More than that, nothing of what I have said so far is particular to holes, as opposed to any other portions of space-time that we would not traditionally think of as being occupied by paradigm material objects. That is a nice feature of the account: it treats all regions of space-time as being occupied by entities of the same fundamental kind: material beings. But none of that tells us in virtue of what a particular space-time region is occupied by a statue as opposed to a dog, or occupied by a hole as opposed to a non-paradigm being for which we likely have no name. The idea is that there is nothing more problematic in principle in determining under what conditions a being counts as being a hole, than there is in determining under what conditions a being counts as being a dog. Still, something more should be said about holes and their relations to other material entities, both paradigm and non-paradigm.

Consider the following diagram where B and C are paradigm material objects and D and F are holes in C and B respectively. Since the diagram is two, rather than three dimensional, F is an internal hole in B, rather than a tunnel through B. E is the complement of B and C. What is the relation between D and C, and between B and F, and in virtue of what are D and F holes *in* C and B?



Casati and Varzi suggest that we adopt what they call the minimal theory of immaterial beings, according to which for every material body, there exists an immaterial being that shares exactly the same location—immaterial beings occupied by material beings—plus some immaterial being or beings that occupy the complement of all of the material beings. So they hold that D is part of E, and E is an immaterial being, while F is an immaterial being proper.<sup>21</sup> According to Hoffman and Richards, D is part of C and F is part of B, where D and F are negative parts of C and B respectively.

Hole conventionalism has a nice way of dealing with this dispute. If every filled region contains some material entity, then there is some entity—call it B\*—that occupies the region jointly occupied by B and F, and which has B and



F as parts. Similarly, there is some entity— $C^*$ —that occupies the region jointly occupied by C and D, and which has C and D as parts. There is also an entity that occupies E (a spatially discontinuous entity), and has F and D as parts. Then the question of whether D is part of C, and F part of B, or whether D and F are parts of E has a straightforward answer. Strictly speaking, D and F are not parts of either C or B. But there is some object that looks a lot like a paradigm material object, of which they are parts: namely  $C^*$  and  $B^*$  respectively. In part then, we can construe this as a semantic debate. The issue is whether when we refer to some material object in the bottom right hand corner of the page, we are referring to C, or to  $C^*$ . If our referring term picks out C, then D is not part of that object. If the term picks out  $C^*$ , then D is part of that object, but it is also part of E. Casati and Varzi think that when we refer to the object in that region we are referring to C, Hoffman and Richards think we are referring to  $C^*$ . In one sense the debate is metaphysical: do paradigm objects have holes as parts?; in another sense, the debate is semantic: there are two possible candidates to be the referents of our term, and the question is, to which does our object language refer.

It's not clear that there is, or need be, a univocal answer to that question. If we thought there was some deep metaphysical difference between E, F and D on the one hand, and B and C on the other, then we might have some principled reason to prefer one view over the other. We might, for instance, hold that material beings always have all and only material parts, and likewise for immaterial beings, whilst hybrid beings are those that have some material parts and some immaterial parts. Then if we had reason to suppose that in general, our terms tend to refer either to material beings or to immaterial beings but not to hybrid beings, (a not wholly implausible thought), then it follows that our object term picks out C not  $C^*$  (since  $C^*$  is a hybrid being) and thus it follows that D is not part of the paradigm material being in question. Alternatively, if we thought that composition was restricted in certain important ways such that for any two entities, there exists a fusion of those entities only if they are of the same fundamental ontological kind—both material or both immaterial—then we would conclude that  $C^*$  does not exist, and hence that our object term does not refer to it.

But we know that there is no such principled distinction: according to hole conventionalism, all of the entities in question are material. So the issue regarding of what object D is a part is not one that requires us to think about positive and negative parts or material and immaterial beings, but rather, to examine our semantic intuitions about the reference of our object language.

There is another issue that turns out to be largely semantic given hole conventionalism. Recall that I earlier distinguished between two kinds of inflationary accounts: inclusive and exclusive. Exclusive accounts hold that any region can be wholly occupied by either an immaterial or a material being, but not both. Inclusive accounts hold that both material and immaterial beings can wholly

occupy the same region. Casati and Varzi embrace the inclusive account because they hold that holes are fillable. If a hole is an immaterial being, and holes are fillable, then immaterial beings must be able to be occupied by, or coincide with, material beings. The exclusive account cannot allow that a hole persists after it is filled. Indeed, the exclusive view presumably cannot even say that there is some entity that persists through the filling, though that entity ceases to be a hole at the end: for prior to filling there exist an immaterial being, and after, a material being.

As I see it, folk intuitions alone don't adequately distinguish between these two alternatives. We certainly talk about holes being filled in, or the process of filling a hole. But it is unclear if we think that there is still a *hole*, albeit filled, after the filling is complete. Hole conventionalism has a nice way of dealing with this issue too. Hole conventionalism naturally rejects the idea that there are coincidental material and immaterial beings. There is just one entity, *D*, though *D* may go from failing to be composed of many matter particles, to being composed of a larger number of matter particles. That is, I take that being a hole is not an essential property of *D*—otherwise if being filled in renders *D* no longer a hole, then it means *D* ceases to exist and some other entity *D\** comes into existence. That position is consistent with hole conventionalism. But I take it that it is more likely that one would maintain that it is largely a semantic matter whether something counts as a hole after it is filled in (and hence not something that determines the persistence or not, of an entity). Then the hole conventionalist can maintain that *D* persists throughout the filling process, hence explaining our tendency to talk as though there is something that can be filled, and which exists post-filling (contra the exclusive view). But it might well be that *D* no longer has the property of being a hole (contra the inclusive view). Plausibly, to talk of there being a hole in the road (when the hole has been filled) makes little sense.

It seems plausible then, that the hole conventionalist will say that being a hole is not an essential property of any entity, and nor is it an intrinsic property. That latter is hardly surprising. Holes are holes in things. So while *D* might be a hole *simpliciter*, it is so only in virtue of being a hole *in C*. But in virtue of what is *D* a hole *in C*? Under exactly what conditions an entity counts as being a hole in some other entity depends on a whole range of conditions that vary from context to context. Giving sufficient conditions for hole-hood is hard. But we can at least think of some general necessary conditions. There is something right about the idea of holes as absences— but not as absences of everything, and hence as causally inert, empty region of space-time. Rather, holes are perfectly ordinary material beings, it is just that they count as being holes in something just if certain relations hold between them and other entities.

A hole in a paradigm material object is usually an entity that occupies a region of space-time where the density of matter particles is significantly lower

than in the region occupied by the material object, and where those matter particles are moving significantly more than the matter particles in the region occupied by the material object. It is not, therefore, an immaterial entity: but it is an entity composed of *less* matter, and where what matter there is, is not bonded together in relatively dense clumps but is spread out thinly. So a hole in a paradigm material object is an entity where the amount of matter in any arbitrary sub-region at which the hole exists, is substantially less than the amount of matter in any arbitrary sub-region at which the entity in which it is a hole exists. Exactly how much less matter there needs to be for something to count as a hole no doubt depends on context.

And not all holes need be in paradigm material objects. Various non-matter fields might have holes. In that case, an entity might count as being a hole in a particular field, if the (fluctuating) value of that field through the region at which the entity exists, is substantially lower than the (fluctuating) value of the field in some surrounding region. Once again, exactly how much lower the value needs to be in some region for the entity in that region to count as a hole in the field is unclear: our conventions are not sufficiently well honed to answer that question as yet. The broad idea is clear enough though. There needs to be a particular sort of relational property between holes and the entities in which those entities are holes, a relational property of the following form: if the value of the matter or non-matter fields across the region  $R$  at which some entity  $E$  exists is fairly uniform, and the value of the matter or non-fields across the region  $R^*$  at which some entity  $E^*$  exists is fairly uniform, then the value of those fields across  $R^*$  is significantly less than the value of the fields across  $R$ . Call relational properties of this kind H-properties. Then one necessary condition for  $E^*$  being a hole in  $E$ , is that  $E$  and  $E^*$  are H-property related. In addition to that,  $E$  and  $E^*$  must be topologically arranged in a particular way. For a start, they must be spatially contiguous. More than that,  $E$  must have one of a range of particular topologies. Much of the work specifying those topologies has been done by Casati and Varzi. Call those topologies H-topologies. Then  $E$  and  $E^*$  must be spatially contiguous, and  $E$  must have an H-topology. Roughly speaking, these are the necessary conditions for some entity  $E^*$  to count as being a hole in  $E$ .

The exact details don't matter: for we are not specifying metaphysical criteria that determine when some kind of entity—an immaterial being—falls under a particular natural kind—hole-hood. We are simply outlining some of the more basic conventions that determine when some material entity will count as being a hole.

#### *4.1 Holes and The Void*

There is, however, one final issue. I have argued that identifying holes with portions of stuff is no more problematic than identifying paradigm material beings

with such portions. But, it might be argued, all of this relies on the fact that in our world, every space-time region is filled. Yet surely there could be worlds in which there are holes, but those holes are not filled with anything.<sup>22</sup> And if that is the case, it would be odd to say that holes in our world are token identical to portions of stuff, but holes in other worlds are token identical to ‘voids’. So if there are such voids, then perhaps it is wrong to say that actual holes are identical to portions of stuff. We need to clarify a little here. There are two different senses in which we might understand the idea of a void. Suppose we are not substantivalists about space-time: we reject the idea that there is any fabric of space, instead holding that there exist material objects—filled regions of space-time—and the relations between such objects. A void in such a world is a true void; an absence of *anything*. I set aside this view, first because it is not clear that the idea of a void in this sense is coherent, and second, because this would not be a world in which holes, if there were any, were immaterial beings. At best, in this world we could identify holes with surfaces of, and relations between, material objects.

But there is another sense in which we might think of a void. Recall I earlier introduced the idea of basic space, where basic space is the spatial fabric. That fabric might be qualified or unqualified, giving us the idea of qualified versus unqualified space. Then we can think of a region of unqualified space as being a weak void—an unfilled space-time region. Now, I argued that in our world there is no unqualified space, and hence no weak voids. But in a world with weak voids, it looks as though we want to say that at least some holes might be just such voids. That might push us to say that we should identify holes with certain regions of basic space. In a weak void world, (some) holes are regions of basic space that are unqualified; in our world all holes are regions of basic space that are qualified—it is contingently the case that in our world, all the holes are filled. For we know that actual holes have weak void counterparts, thus we should not identify actual holes with any hole filling. Something like this looks a lot like Casati and Varzi’s view, and I am not wholly unsympathetic. If we think that this is a good account of space, then it might be a good account of holes. Then there really do exist immaterial beings in every region of our world, all of which are contingently filled with material beings of some kind, paradigm or not, including holes. So in fact the issue is not whether there is *any* object that exists precisely where we pre-theoretically suppose there to be a hole, for actually there exist two: an immaterial being composed of basic space, and a non-paradigm material object that occupies just the same region as the immaterial being. The hole turns out to be the immaterial rather than the material being on this view, because the hole could have existed without the material being with which it coincides existing, as evidenced by our weak void world.

This presupposes a particular conception of basic space, one according to which we can imagine God making a world of basic space, and then qualifying that space in various regions. The sense in which it is contingent that every region of space-time in our world is qualified, is the sense in which when God laid out the basic space, He decided to qualify every region, though it is true of those regions that each *could* have been unqualified. That is, there are relatively close counterparts of actual space-time regions, such that those counterparts are made of the same basic space, which is unqualified.

If this is our picture of space, then it probably makes sense to think of holes as being composed of basic space. But the other possibility is that God did not first make basic space and then qualify it, but rather, that God distributed a bunch of qualities, and in doing so created space. What it is for there to be space is for there to be this distribution of qualities. Then there is no basic space that, as it were, lies beneath the qualified space, such that that very same space could have been unqualified. There is qualified space, and that is all. So it is not merely contingent that in our world all space is qualified. In what way? That depends. Perhaps it is logically necessary that what it takes to make space is to distribute qualities. Then there are no weak void worlds, and hence holes are never weak voids. It is hard to evaluate that claim, but it is not obvious that basic unqualified space is logically impossible. But it might well be nomologically or metaphysically impossible. In that case, the actual world and its close counterparts are all ones in which space is qualified. In these worlds there is no basic space, and hence it is not true that any region of space could have been unqualified: removing the qualities removes the space. So in these worlds we cannot identify holes with regions of basic space that contingently happen to be filled in virtue of the space being qualified: for there is *only* qualified space. So actual holes must be token identical to these filled regions.

I do not intend to adjudicate between these two views about space. But it is worth noting that if we are happy to identify holes with filled regions as I suggest, then actual holes are in no danger regardless of what view of space we embrace. On the other hand, if we suppose that holes are regions of basic space, and it turns out that actually there is no basic space, then it turns out that actually there are no holes. But it does not seem that the existence or not of holes is likely to stand or fall on *recherché* details such as these. And that, at least, is some reason to prefer hole-conventionalism to the view that holes are immaterial beings, or at least, that holes are immaterial beings by their very nature. Moreover, suppose the actual world is one in which there is basic space, but there are logically possible worlds in which there is no basic space. Then it still seems plausible that there exist holes in the counterfactual worlds in which there is no basic space. That is, even if *actually* there is basic space, it is not at all clear that our concept <hole> rigidly picks out all and only the immaterial beings in actual

and counterfactual worlds. So if we think that it is logically possible that there are worlds with no basic space, then likely we think that there are holes that are not immaterial beings. In essence, this means that if there are weak void worlds then some holes are what we might plausibly think of as immaterial beings, but that is not *definitive* of hole-hood. What it is to be a hole is not, I think, to be an immaterial being, though perhaps some holes in some worlds are immaterial beings.<sup>23</sup>

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#### NOTES

1. By 'entities' I intend to refer to anything—material or immaterial—over which one can quantify.

2. I sometimes talk of material or immaterial beings, and other times of material or immaterial objects. These are strictly interchangeable terms, and are used in the manner they are simply for grammatical ease.

3. I will frequently talk of paradigm material objects, by which I just mean the everyday macro objects of our ontology—statues, dogs, persons, tables—and whatever material entities are posited by the sciences. It may be that the paradigm material objects are the material objects *simpliciter*, though if, for instance, unrestricted composition is true, then there are various odd gerrymandered objects that are material objects but not paradigm ones. Moreover, since I defend the view that holes are material beings, but are not identical to any parts or surfaces of paradigm material beings, it is useful to distinguish material beings *simpliciter*, from paradigm material beings.

4. Casati and Varzi 1994: 34.

5. Hoffman and Richards 1984.

6. Hoffman and Richards 1984: 85.

7. Jackson 1977: 131f.

8. Lewis and Lewis 1970.

9. Casati and Varzi 1994: 18, for instance, explicitly hold that holes are ontologically dependent in this manner.

10. Casati and Varzi 2003.

11. See for instance Heller 1990, chapter 1.

12. This is of course Lewis' 1986 view, and one that Sider 2001 also countenances.

13. Casati and Varzi 1994: 35.

14. Casati and Varzi 1994: 35 make this point.

15. Casati and Varzi 1994: 33.

16. 'Exclusive' because any region wholly contains, exclusively, a material or an immaterial being.

17. Since some regions contain, inclusively, both material and immaterial beings.

18. I use 'stuff' here in the broadest way not to mean just material stuff, that is, matter particles, but to mean whatever it is that fills any non-empty space-time region. Then non-matter fields and particles will count as stuff.

19. Or perhaps, every filled region of space-time that is larger than Planck length and whose dimensions are multiples of the Planck length, is wholly occupied by some entity.

20. At least, it ceases to be a problem in the actual world since we can either (contingently) identify holes with portions of stuff, or hold that they are constituted by such portions. I return in section four to consider what to say about other worlds.

21. They note that F is an immaterial being proper, while D is a proper part of E. That is a little confusing, since F is also clearly a proper part of E. Presumably the idea is that D is a proper part of the external complement of B and C and hence D is spatially contiguous with that external complement, while F counts as being an immaterial being proper, because it is an internal complement of B and C, and is not spatially contiguous with the external complement. See Casati and Varzi 1994: 36.

22. Casati and Varzi 1994: 35 make this point.

23. With thanks to David Braddon-Mitchell and Achille Varzi for many helpful comments.

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