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Is distinct location evidence of distinct objects? Multilocation and the problem of parsimony

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Abstract

For an object to be multilocated is for it to wholly occupy disjoint spatial regions simultaneously. If multilocation is possible, it is possible that a multilocated particle is wholly located at 10^{80} distinct locations, such that it constitutes a particle-for-particle duplicate of the actual universe. Such a universe would presumably be perceptually identical to the actual universe. If we take multilocation as possible, we are thus presented with two accounts between which our perceptual evidence cannot adjudicate: one wherein the universe is constituted by many particles and another wherein it is constituted by one radically multilocated particle. Parsimony concerns dictate that the latter is the more rational to accept. Since this is absurd, we should reject that multilocation is possible. Mooney responds to the problem by arguing that distinct location is evidence of nonidentity, even if acceptance of the possibility of multilocation entails that this evidence is not decisive. If this is right, then the evidence favors a theory featuring many particles. In this paper, I contend that our commitment to taking distinct location as evidence of nonidentity is motivated by a more fundamental intuition that does not apply in the relevant context.

For an object x to be multilocated is for x to wholly occupy spatial regions s_1 and s_2 simultaneously, where s_1 and s_2 are disjoint. Hudson (2008) develops the Problem of Parsimony as reason against accepting the possibility of multilocation. Hudson formulates the problem by considering the consequences of assuming that there are some possible worlds containing multilocated objects. "[C]ould a multiply located object be a simple[1] simultaneously appearing in some 10^{28} distinct regions and entering into various spatio-temporal relations with itself, resulting in what appears to be a particle-for-particle duplicate of a polar bear?" (Hudson, 2008, 113). Once we accept the possibility of multilocation, there does not seem to be any principled reason for thinking this case is impossible. But this suggests a more dramatic possibility: "could a multiply located simple be simultaneously located at each of some 10^{80} distinct regions…[2] all the while entering into various spatio-temporal relations with itself, resulting in what appears to be a particle-for-particle duplicate of the actual world from the time of the big bang to the present moment?" (Hudson, 2008, 114). Without placing arbitrary restrictions on multilocation, it seems we must accept this possibility. Furthermore, a universe consisting of only one radically multilocated simple would presumably be perceptually identical to our own universe. If we take multilocation as possible, we are thus presented with two theories between which perceptual evidence cannot adjudicate: one wherein the universe is constituted[3] by many simples and one wherein the universe is constituted by a single multilocated simple in various spatiotemporal relations with itself (the many-simples theory and the single-simple theory, respectively).

Presented with this impasse, Hudson invokes a common method of inference to the best explanation through a principle of parsimony. The relevant principle of parsimony states that, of any pool of theories equally compatible with a total body of evidence, the theory which is most ontologically parsimonious is the more likely to be true.[4] In other words, if we have evaluated the evidence and we are unable to adjudicate between two theories, it is most rational to accept the theory requiring the fewest ontological commitments, where an ontological commitment is understood to be an acceptance of the existence of some entity.

If we accept such a principle, as many commonly do, we can adjudicate between the many-simples theory and the single-simple theory. On Hudson's construction of the problem, the many-simples theory requires at least 10^{80} ontological commitments, while the single-simple theory requires only one.[5] Thus, given their equal explanatory power and coherence with the evidence, the single-simple theory is the most parsimonious and therefore the more rational to

[1]Both Hudson (2008) and Mooney (2018) cast this problem in terms of mereological simples, but they need not have done so. We could just as easily imagine a mereologically complex particle playing the same role that the simple does in this formulation of the problem. Thus, while I follow Hudson's and Mooney's vocabulary, the problem arises regardless of what commitments the multilocation theorist might have about simples. This is addressed further below.

[2]This number (10^{80}) corresponds to the approximate number of atoms in the universe. As atoms are not mereologically simple, it is possible that the proper number is a few orders of magnitude higher.

[3]Where possible, I explicate this debate in terms of constitution. Mooney prefers composition and notes that Hudson seems to prefer a relation of identity. While I do not take issue with the possibility of composition relations holding between several instances of a multilocated object, anyone will who accepts a Weak Supplementation Principle: "For all x and y, if x is a proper part of y, then there is some z such that z is a proper part of y and z does not overlap x" (Wasserman, 2018, 215). See also Effingham and Robson (2007).

[4]While some popular conceptions of the principle of parsimony quantify only over types, the operative version of the principle in Hudson's presentation of the problem quantifies over tokens.

[5]Both theories will also require ontological commitments about what is constituted by the simples. However, these are presumably of the same number on both theories, so nothing turns on those ontological commitments.

accept. But since this result is absurd, we ought to reject the original assumption that multilocation is possible. Mooney (2018) argues—against Hudson—that the possibility of multilocation does not change our perceptual experience of the world, and our perceptual experience suggests objects in distinct locations are distinct objects. Rather, distinct location is evidence of nonidentity, even if the acceptance of the possibility of multilocation requires that this evidence is not decisive. If this is right, then one need not consult the principle of parsimony, as the evidence is greater in favor of the many-simples theory and the Problem of Parsimony never arises for the multilocation theorist. In this paper, I present a counterargument to Mooney. I contend that the intuitive commitment to taking distinct location as evidence of nonidentity is motivated by a more fundamental intuition: that distinct location is evidence of distinct qualities. As this presumably would not apply on the single-simple theory, Mooney's argument does not successfully skirt the problem.

Mooney first notes that there are several available strategies for overcoming the Problem of Parsimony:

> We might deny that a whole universe could be composed of one particle by endorsing some principled restriction on multilocation. For example, one might think there are causal restrictions which ground diachronic identity, and that these restrictions prevent the recombinatorial step in the argument from going through. Other options include denying that we ought to prefer parsimonious theories, or denying that the single-simple theory is more parsimonious than its rival (Mooney, 2018, 154).

Any of these options might work, and I leave them open to the multilocation theorist. But Mooney favors a different approach, which I contend is inadequate. Mooney's argument relies on two commonsense principles. First, "objects occupying different places at the same time appear to be distinct from each other" (Mooney, 2018, 154). Second, "the way things perceptually appear is evidence of the way they are" (Mooney, 2018, 155). Immediately following from these two principles is: "[t]hat spatially separated simultaneous objects appear distinct is evidence that they are distinct, even though my experiences would be the same if some of these objects were identical to each other and multilocated" (Mooney, 2018, 155). Thus, on Mooney's view, the single-simple theory is possible, but the evidence vastly favors the many-simples theory.

If one goes to the zoo and sees what appear to be three zebras, one has evidence that there are three zebras at the zoo, even if the perception is compatible with there being three mules at the zoo cleverly disguised as zebras. Similarly, "[t]hat the several, spatially separated zebras at the zoo appear to be distinct is evidence that they are distinct, even if they would look no different were they a single, time-traveling zebra" (Mooney, 2018, 155). Though we would not deny the possibility of three mules being disguised as zebras, we are still likely to take perceptual experience of three zebras as evidence that there are three zebras at the zoo. The possibility of the alternative does not, in this case, force us to deny the suggestion of the evidence. Likewise, because perception by-and-large dictates that distinct location is evidence of nonidentity, even having accepted multilocation as possible, there is more evidence in favor of the nonidentity of distinctly located objects than there is of their identity. If this is right, the evidence in favor of the many-simples theory vastly outweighs that in favor of the single-simple theory, so parsimony concerns do not bear on the issue. We thus should not accept the single-simple theory, even given the possibility of multilocation, so says Mooney.

Recall the two principles that Mooney endorses in order to reach his conclusion: (i) objects occupying distinct locations appear to be distinct objects and (ii) the way things appear is evidence of the way they are. I think these are both, generally speaking, true. I will leave (ii) alone, as a denial of (ii) seems to me like a species of the skeptical thesis, which Mooney deals with quite handily. Instead, I want to focus on (i). I think there is an underlying principle on account of which we are inclined to accept (i). Thus, we must interrogate our intuition that (i) is true. As I go about my life, when I see two objects in distinct locations, I generally take this as sufficient evidence of their distinctness. What I mainly want to call into question is the applicability of this intuition to our consideration of the single-simple theory. My strategy will thus be to present a counterexample where this intuition seems not to apply, and then to show that this counterexample is a better analogy for the impasse between the single-simple theory and the many-simples theory than Mooney's zebra case.

So, why do we accept that objects in distinct locations appear to be distinct objects, even when we take multilocation as possible? I offer that this is because we generally find that distinct location correlates with distinct qualities. Wherever you are right now, I take it to be quite probable that you are surrounded by a great deal of qualitative variety. It is likely that the walls are a different color and texture than your clothes, whatever noises you hear on your left may be distinct from those on your right, etc. To avoid belaboring the point: I take it as uncontroversial that the world is full of qualitative variety. Importantly, that qualitative variety tracks location distinctions quite well. Of course, while it may be possible for certain qualities to occupy[6] the same space (e.g., the color and texture of your shirt), some qualities cannot do so: redness and blueness are incompatible qualities and thus any instances of them entail spatiotemporal separation. So, the presence of incompatible qualities in given objects implies that said objects exist in different spatial regions. Similarly, qualitative distinctness tends to correlate strongly with numerical distinctness as well. That is, if we are simultaneously presented with two objects, one wholly red and one wholly blue, we generally take this to be sufficient evidence that the two objects are numerically distinct.[7] Of course, this relation may not hold in the inverse: numerical distinctness may not imply qualitative distinctness. But there is, no doubt, a correlation. For any two numerically distinct objects *x* and *y*, it is almost always the case that *x* and *y* are qualitatively distinct in some scope. Even in cases where we are presented with objects that superficially appear to be qualitatively identical, we tend to be able to find qualitative distinctions if we look hard enough and with the right tools.

I mean here to illustrate that distinct location, qualitative distinction, and numerical distinction are all closely tied together in our perceptions, and thus, in our intuitions. Mooney contends that objects in distinct locations appear to be distinct objects; I contend that the reason for this is that objects in distinct locations tend to be qualitatively distinct, and qualitatively distinct objects tend to be numerically distinct. There is a throughline in these inferences which offers an account of why Mooney's principle is intuitive. Of course, this is quite speculative: I am only offering one possible account of why Mooney's principle is an intuitive one. But I think the following example will suggest that I am right. When we remove the

[6]It is not clear that qualities are the kinds of things that can occupy locations. This is just a convenient way of speaking. What I mean when I say a quality occupies a space is that some object exhibits compatible qualities (e.g., blueness and hardness) and our perceptions associate those qualities with one object in one region of space.

[7]I am not here committed to the view that qualitative distinction entails numerical distinction (on most theories I am qualitatively distinct from but numerically identical to my younger self). In fact, I am not even necessarily committed to the view that synchronic qualitative distinction entails numerical distinction: certain time travel cases (wherein my older self and younger self exist simultaneously) would break this commitment. I am committed to something much weaker: qualitative distinction *strongly implies* numerical distinction.

possibility of qualitative distinction from Mooney's zebra example, I imagine our intuitions will change. Mooney says that, even on the assumption that multilocation is possible, we are still inclined to take the perception of zebras in three distinct locations as evidence of three numerically distinct zebras, rather than of one multilocated zebra. But now imagine that these zebras are qualitatively identical to one another. The zebras all have the same number of stripes, they are all the same height, they have tails of matching length, etc. Furthermore, imagine that the zoo has offered for you to make use of all the tools and expertise at their disposal for observation of these zebras. Thus, we find that the zebras have precisely the same number of hair follicles, that they are the same blood type, and that their grazing schedule indicates the same feeding preferences. Perhaps these zebras are simply very genetically similar—triplets, or even clones! But shall we go one step further? Imagine that a nearby university, whose reputation in atomic physics and microphysics is unparalleled, offers an equivalent deal: they allow you to use all of the tools and expertise at their disposal to compare these zebras. In using powerful sub-atomic microscopes and advanced X-ray technology, you find that the zebras share a common sub-atomic structure. Put more strongly, there are no detectable differences between any of these three zebras, all the way down to the sub-atomic level, except for those attributable to the fact that they are in different locations. And let us say that here we reach our investigative limit.

Now, in this new version of the thought experiment, in what direction do our intuitions pull? Keeping in mind that the example calls us to assume that multilocation is possible, it seems to me that much of our reason for thinking that these are numerically distinct zebras is gone. At the very least, I contend that we are now in a position to take more seriously the notion that these are one multilocated zebra. Of course, maybe somewhere a secret technique for perfect sub-atomic duplication of immensely complex systems has been developed. But if we have reason to accept something like that, then we have at least as much reason to accept that this is an instance of multilocation, which we have already recognized as possible. If you share my intuitions in this version of the thought experiment, then I think this lends credence to my claim that our reason for thinking of distinct location as evidence of distinct objects is that distinct location is so closely correlated with qualitative distinction. Once we remove qualitative distinction from the equation, we are less inclined to think that distinct location is evidence of distinct objects, so long as we have also accepted the possibility of multilocation. In other words, as we find that the zebras are qualitatively identical in every available scope, we begin to think it more and more likely that these zebras are one multilocated zebra than that they are three distinct zebras.

Perhaps it is possible that numerically distinct objects are qualitatively identical. But this is not a problem for what I have proposed. All I mean to show is that, once we have accepted the possibility that some given object might be multilocated and we have also sufficiently removed the possibility of qualitative distinction between two given things, we ought to take seriously the notion that the given things are one multilocated object. Our experience coheres equally well with both their being multiple things and their being one multilocated thing, and our intuitions about distinct location do not seem to decide for us in such a case, since our intuitions about qualitative identity play defense against such a move. Thus, in such situations, we must look toward other adjudicating principles, like the principle of parsimony. And the principle of parsimony will tend to favor explanations including multilocated objects, as such explanations force fewer ontological commitments than others do. This does not apply in every situation, of course, given that we rarely have the time or the resources for examining objects to such a radical degree of detail. If I am presented with two seemingly identical zebras, I assume that they are numerically distinct because distinct location generally correlates with qualitative distinction, which implies numerical distinction. Even when things are *seemingly* identical, it is still reasonable to think they are not one multilocated object, as experience tells us that we will find a qualitative difference if we look hard enough. But if we have completed the search for a qualitative difference and exhausted every resource in its pursuit, yet still failed to find one (something that simply does not happen in everyday experience), I contend we then have good reason to abandon the notion that objects in distinct locations appear to be distinct objects.

The last point I would like to make is that our situation with regard to the many-simples/single-simple debate is probably much more like my version of the zebra thought experiment than Mooney's. That is, I think there is good reason to take the mereological fundaments of the universe as qualitatively identical with one another, at least insofar as we are concerned with adjudicating between the many-simples theory and the single-simple theory. Needless to say, not all theories of mereological simples hold that simples are qualitatively homogenous. For instance, the famous theory of simples presented by Markosian (1998) explicitly requires that simples be capable of taking different sizes and shapes, and even leaves it open that these sizes and shapes need not be diachronically static.[8] If the multilocation theorist is happy with such a theory of mereological simples, then perhaps Mooney's argument holds against my counterexample. That said, just because Mooney and Hudson formulate the problem in terms of simples does not mean that the problem cannot arise elsewise. If it can be shown that qualitative variety drops off somewhere along the mereological ladder, then the Problem of Parsimony can arise at that mereological level, regardless of whether or not the relevant subjects of discussion are simples. In other words, when we zoom in on material objects far enough, if we find that their parts are not qualitatively different from one another, then the Problem of Parsimony arises, even if these parts can be divided into further parts. If we keep an eye toward our best physics, there is good reason to think exactly this: that material objects are constituted by qualitatively homogenous fundamental parts.

We know, of course, that atoms differ in some of their qualities. For instance, atoms of different elements are partially composed of electrons at different valence levels. We also know that some quarks have different qualities. For instance, the masses of up and down quarks are characterized by values lower than the other four quark types (Davies et al., 2010). Atoms and quarks then are not the homogenous parts of matter I am looking for. There are, however, physical theories, which posit that the most fundamental objects in the universe do not feature qualitative heterogeneity, but rather are qualitatively identical objects in different states: string theory, for example, holds that the basic particles of physics are one-dimensional objects whose properties are determined by their oscillatory states (Becker et al., 2007, 2). So, on string theory (or anything sufficiently like it in the relevant sense), in conjunction with an acceptance of the possibility of multilocation, it does not seem that we are entitled to the claim that distinct location is evidence of distinct objects. What appears to be a great many quantum strings in many locations could simply be one multilocated quantum string in different vibrational states. We have no reason to think that distinct location is correlated with distinct qualities when considering the mereological fundaments on such a theory. The state of any given fundament may be different from others, but none of the qualities belonging to it *qua* fundament will differ from the qualities of any other. At such a fundamental level, we have good reason to think there are only a great number of qualitatively identical "particles" (or strings, or whatever) in complex arrangements. And since

[8]See Markosian (2004) for a further discussion of this feature of the theory.

multilocation is assumed to be possible, the evidence is equally compatible with both the many-simples theory and the single-simple theory, where we take these mereological fundaments as the relevant simples.[9]

Of course, this puts us right back in the position of being forced to adjudicate between the many-simples theory and the single-simple theory according to some non-evidential basis. Since both theories cohere equally well with the evidence, we should accept the one requiring the fewest ontological commitments. As there are many more quantum objects (or whatever other basic particle fits the bill) than there are atoms in the universe, any version of the many-simples theory informed by our best physics will posit many more than 10^{80} ontological commitments. But any version of the single-simple theory informed by the same physics will only require one ontological commitment.[10] So, I hope to have illustrated that the single-simple theory still comes out on top once we have considered whether or not Mooney's principle applies when considering that the basic building blocks of the universe are not qualitatively distinct from one another.[11]

On these grounds, I contend that the Problem of Parsimony remains for the multilocation theorist, even after taking on board Mooney's argument to the claim that distinct location is evidence of distinct objects. Mooney's principle is almost obviously true, but it is true in virtue of a deeper intuition that does not apply in discussions of the most fundamental building blocks of the material universe. While it is certainly possible that the fundamental building blocks of the universe are qualitatively distinct from one another, we are not entitled to assume that they are. Thus, Mooney's principle, which relies on our intuitions about the relationship between distinct location and qualitative distinctness (and further, about the relationship between qualitative distinctness and numerical distinctness), cannot be assumed to apply. The multilocation theorist

[9]In correspondence, Mooney has pointed out to me that, in the case of ordinary objects (like zebras), we expect to find qualitative distinctions between objects. Thus, the unusual case of qualitatively identical zebras calls out for an unusual explanation (like multilocation). But mereological fundaments are not ordinary objects, and so their qualitative identity with one another might not call out for a similar unusual explanation, perhaps undercutting reasons for relying on multilocation. This may be right; but my view requires not that the evidence favors multilocation, but that the evidence does not decide (as the principle of parsimony can do the rest). So, even if my point forces the evidence in the zebra case to favor multilocation, it does not need to do so for mereological fundaments.

[10]Again, both theories will require commitments about the objects constituted by the simples, but these commitments are presumably of the same number on either theory.

[11]There is good evidence that string theory and similar theories are false. One might thus want to take as unsupported any theory treating basic particles as qualitatively identical. Thus, the single-simple theory is rejected outright: the exhaustive multilocation of one particle is incompatible with any theory which says the relevant particles are fundamentally diverse in kind. For instance, one might think that there are exactly 12 different kinds of fundamental particles, corresponding to the 12 kinds of elementary fermions on the Standard Model. But this does not really escape the spirit of the Problem of Parsimony. While this gives us reason to reject the single-simple theory, it does not give us reason to reject a similar 12-simple theory: that the entire universe is constituted by 12 distinct radically multilocated fermions (such a theory might perhaps miss out on bosons and antiparticles, but the point stands). This puts the multilocation theorist in a better position, but not by much. One could also suggest that there are as many kinds of basic particles as there are basic particles. This would secure the many-simples theory against the Problem of Parsimony, but it would also substantially undermine the scientific project of microphysics: searching for general explanations for the behavior of certain particles will likely fail, as the behavior of each particle is wont to be specific to it and no other, rather than to some general kind.

thus has two theories, which are equally compatible with the evidence: the many-simples theory and the single-simple theory. So long as this is the case, the principle of parsimony should decide for us[12]—and it favors the single-simple theory.[13]

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[12]This is assuming that no other strategy for overcoming the problem will work. As cited above, Mooney suggests several other paths for addressing the problem. Those may be worthwhile. Additionally, I do not much see why it should be thought absurd that the universe is constituted by a single radically multilocated simple. This would be unintuitive, but so are many deep truths about the basic features of our universe. If one has strong motivation for accepting the possibility of multilocation, then perhaps the best response to the "problem" is just to bite the bullet.

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