Bundle Theory and the Identity of Indiscernibles

Philip Swenson and Bradley Rettler February 28, 2019

Abstract

A and B continue their conversation concerning the Identity of Indiscernibles. Both are aware of recent critiques of the principle that haven't received replies; B summarizes those critiques, and A offers the replies that are due. B then raises a new worry.

A. As you know, I remain quite convinced that it is impossible for two distinct objects to have all of their attributes in common.

B. But surely you remember that there is a well-known and decisive objection to this view of yours. Isn't there is a possible world that contains nothing but two completely indiscernible spheres located some distance apart from each other? These spheres could be intrinsically indiscernible in virtue of having the same size, composition, temperature, etc. And furthermore, since they would be the only two things in existence, they could share all of the same qualitative relational properties as well.[1] Isn't this a case in which we have two genuinely indiscernible objects that are nonetheless distinct?

A. One might think so, but I have come to see that objects such as spheres are nothing more than bundles of universals. And also that there cannot be two distinct objects that are bundles of all and only the same universals. Thus I must conclude that there cannot be two genuinely distinct spheres in the scenario you describe above.

B. Well, I do agree that you have talked yourself into accepting some metaphysical theses that are jointly inconsistent with the possibility of the two-sphere case as I have described it, but how do you account for the fact that it does seem to be possible?

A. I should say something about that, shouldn't I? There is actually a quite simple explanation available to me. The trick is to see that universals can be bi-located, by which I mean that they can be wholly located in two different places at the same time. Redness, for example, can be wholly located in the painting on the wall, while at the same time being wholly located in the cup I hold in my hand.[2] Once one understands this, it becomes clear that bundles of universals can also be bi-located. And this is the key to understanding your "two sphere" case. What we are actually imagining is

[1] See (Black 1952).

[2] A is assuming an immanent understanding of universals.

one sphere—one bundle of universals—wholly located in two separate places.[3]

B. Hmm, I'm somewhat inclined to just stomp my foot and say 'No! What I am imagining is two distinct but indiscernible spheres.'

A. I don't see how you would be able to tell the difference. Perhaps you are overestimating the precision of your modal intuitions?

B. Well I won't rest my case just on that. I think there are several serious objections that should lead us to reject this solution of yours.

A. I'm all ears.

B. Let's start with this one. Even though the two spheres in our example have all of the same attributes, it certainly seems to be metaphysically possible for them to have been different. For example, one of them could have had a slightly higher temperature than the other one. But if your suggested view is right and the "two" spheres are really just one bi-located sphere, then of course one of "them" could not have been different from the other. But this seems to be clearly false.[4]

A. Well, you know that I think there is only one (bi-located) sphere. And of course, it is necessary that the one sphere is identical to itself and not identical to anything distinct from itself. So, I naturally deny that it could have been distinct from itself.

But to your point: don't forget that I also endorse counterpart theory. On my view, what is going on in the case you describe is that there is a world in which our one (bi-located) sphere has two distinct (non-bi-located) counterparts and one of these counterparts has a slightly higher temperature than the other. After all, we know that the counterpart relation is context-sensitive, and things can have multiple counterparts in the same world.[5]

B. So you are saying that this one sphere could have been two different spheres?

A. It depends what you mean by that. If you are saying that there is a world W such that in W our sphere has temperature t and in W our sphere has temperature $t+1$, then yes, that is true. This is because it's true that "this sphere could have had temperature t", and it's true that "this sphere could have had temperature $t+1$".

[3] This reply is due to O'Leary-Hawthorne (1995).

[4] This objection comes from Zimmerman (1997). See also (Adams 1979). The immediately following portion of the dialogue draws from and adds to Zimmerman's discussion.

[5] See Lewis (1986, p215), who says that Hubert Humphrey has twin-counterparts at some worlds, and (p253), where he says that "one world can make conflicting representations *de re* concerning that one thing". See also (Bacon 2014).

Our sphere has a counterpart in W that has temperature t and our sphere also has a (distinct) counterpart in W that has temperature $t + 1$.

But if you mean that there is a world W such that our sphere has a counterpart x in W such that x has temperature t and *that same sphere* x also has temperature $t+1$, then that is of course false. Spheres that have different temperatures are numerically distinct, so it's impossible that our sphere has a counterpart in W that has temperature t and a counterpart in W that has temperature $t+1$ *and* that those two distinct spheres are identical.[6]

B. Well, I don't think you have really solved the problem. I claim that in the two-sphere case one of the spheres could have changed temperature while the other sphere remained unchanged. But if there is only one sphere, then of course it has all of the same counterparts as itself. Consequently, if you are right, there is no possible world in which one of the spheres has a counterpart with a certain temperature, while the other sphere does not have that counterpart. Even previous defenders of your view have admitted that counterpart theory does not provide sufficient resources for dealing with this objection.[7]

A. That was a mistake on their part. We say that the one sphere could have changed temperature while the other sphere did not, but this does not show that the "two" spheres are not identical.

B. I don't see how you can avoid that result.

A. There is a world in which the bi-located sphere has two counterparts, one of which has a different temperature and one of which doesn't.

Recall Lewis's example of the Great Western Railway.[8] The Great Western ('GWR') was identical to a certain line of track. (Call this line of track 'GWR-'.) But GWR could have been bigger. That is, there is a world W* in which a counterpart of GWR is identical to a longer line of track. (Call this counterpart 'C'.) Now what should we say about GWR-? It seems that GWR- could not have been bigger than it was. So GWR- has a counterpart in W* that is a proper part of C. But it follows from all this that GWR could have been bigger while GWR- stayed the same size. This is true despite the fact that GWR and GWR- were (in our world) identical. There are two potential counterparts for GWR/GWR- in W*, one of which is selected by each name.

Similarly, we can say, "the one sphere could have changed temperature while the other remained unchanged", despite the fact that "the one sphere" and "the other" refer to the same object—our one bi-located sphere. This is true because there are

[6] See again Lewis (1986) §4.5, especially p253.

[7] i.e. Zimmerman's (1997) character A.

[8] See Lewis (1986, p248-251).

worlds that represent our sphere in (at least) two different ways (just as W^* represents GWR/GRW- in two different ways). And we are picking out a different counterpart relation—and thus different counterparts—when we use "the one sphere that could have changed temperature" and "the other that remained unchanged".

B. But there is an important difference between the two-sphere case and the Great Western Railway example. As Lewis points out, the reason we get different modal results for GWR and GWR- is that the two different names bring out or make salient two different ways in which the relevant world represents the object in question. The name "GWR" evokes the representation according to which the object is bigger, while the name "GWR-" brings out the representation according to which the object is not bigger. But in discussing the two sphere case I have used "the one" and "the other" to pick out the spheres. And "the one" and "the other" appear to be neutral with regard to which manner of representation they invoke, so I don't see how you get the result that the truth of 'the one sphere could have changed temperature while the other sphere remained unchanged' can be accounted for by appealing to different ways in which the world represents a single object. What accounts for the switch from the first manner of representation to the second?

A. Lewis points out that the when you make a claim about necessity or possibility there is a "rule of accommodation" which (insofar as is possible) brings out a context in which your modal claim is represented as being true. For example, if I claim that my origin is essential to me, I create a context in which the standards for what count as one of my counterparts are set high enough that nothing with a different origin will count as one of my counterparts.[9] Similarly, when you claim that "The one sphere could have changed temperature", you create a context in which the manner of representation that makes your statement true is evoked. And when you say 'the other sphere remained unchanged' you create a new context that makes it the case that this second statement is true as well. Just as with the GWR case, we have two different potential counterparts available: the sphere with the same temperature and the sphere with the slightly higher temperature. And there will be manners of representation that will select each of these as the counterpart. The work of selecting the manner of representation is not done entirely by the name you use for the object. The rule of accommodation accounts for why "the one" and "the other" evoke two different manners of representation.[10]

B. What if instead of moving from cases of indiscernibility to cases of near indiscernibility we do things the other way around? Start with the world where two distinct spheres a and b differ only in virtue of a slight difference in temperature; a has temperature t and b has temperature $t + 1$. Surely a could have had temperature

[9] See Lewis (1986, p. 253).

[10] See Lewis (1979), especially p347.

$t+1$. Thus, it appears that if our world with two distinct nearly indiscernible spheres is possible, then a world with two distinct and completely indiscernible spheres is also possible.[11]

A. I agree that a could have had temperature $t+1$. But for all we know, this modal fact is made true by a having a counterpart that has temperature $t+1$ in a world with just one (non-bi-located) sphere.

B. What I mean to say is that surely a and b could have both had temperature $t+1$.

A. This is also true, but it is not made true by a world in which there are two distinct, indiscernible spheres, but rather by a world in which we have one bi-located sphere! This one bi-located sphere serves as a counterpart to both a and b.

B. But still, it's just crazy to think that two worlds which differ qualitatively only in virtue of a slight difference in the temperature of one object also differ with regard to how many objects exist.[12]

A. In order for there to be different objects, there must be a something that differentiates them. Since I'm a bundle theorist, I think that objects are made up of universals. If two objects have all the same universals, then nothing differentiates them; and if nothing differentiates them, then they are not two objects but one. In the two-sphere world, what differentiates the spheres is that one has temperature t and one has temperature $t+1$; that difference of universals is what differentiates the spheres. But the one-sphere world is a one-sphere world precisely because nothing differentiates the bundles. If there were such a thing, the spheres wouldn't be indiscernible!

Now that I have a better understanding of how bundle theory works, the two worlds differing with regard to how many objects exist really doesn't seem so crazy to me. In the first world we have two bundles of properties, and in the second world we have one. Thus, we have two objects in the first world and one in the second. And even if this result is slightly counterintuitive, recall that I think that bundle theory has theoretical advantages—especially avoiding commitment to a mysterious substratum—and I think those advantages are enough to outweigh this.[13]

B. Hmm, your view still seems crazy to me, I think I can make the absurdity more evident if I appeal to a slightly different example.

[11] This argument is drawn from Rodriguez-Pereyra (2004). For a similar argument see Adams (1979).

[12] See (Zimmerman 1997).

[13] See again Zimmerman (1997), which begins with A stating this virtue of bundle theory. A related advantage is the reduction of the category 'object' to the category 'property'.

A. Let's see.

B. Suppose we have a completely symmetrical universe in which all that ever exists are two (seemingly distinct) groups of 10 million stars. One side of the universe contains one group of 10 million stars and the other side contains a qualitatively identical group. Each individual star has a qualitative duplicate on the other side of the universe and there is no way to differentiate between a star and its duplicate by appealing to relational facts. Aren't you committed to saying that what we really have is 10 million bi-located stars?[14]

A. Yes, that's what I would say.

B. But now consider a second universe that is qualitatively identical to the first up to time t. At time t, however, a single particle appears which breaks the symmetry and makes it possible to differentiate between the two groups of stars. Surely you would not say that the appearance of a single particle causes 10 million stars to come into existence?

A. No, I would say that there have always been 20 million stars.

B. I thought you would. But then whether 10 or 20 million stars exist in a world at time depends on whether at some time in the future a certain particle appears in a particular location. Surely this is absurd!

A. Recall what I said above; if there are 20 million stars, there must be something to differentiate 10 million of them from the other 10 million. If there isn't any such thing and won't ever be, then there are only 10 million stars. We can't appeal to extrinsic spatial relations, because they are symmetric, and so for every star there will be one on the other side that is its duplicate.

Furthermore, I have become a perdurantist, and I think that things have temporal parts.[15] Prior to the appearance of the particle, we have 10 million "star segments." In the case where the symmetry-ending particle does appear, each of these segments is a temporal part of two distinct stars. In the case where the symmetry-ending particle does not appear, each of these segments is a temporal part of only one star.[16] Once one accepts temporal parts, it is easy to see how future events are relevant to the question of which objects exist. In the first case, 20 million stars exist all along, while in the second case, we have only 10 million stars. Remember what we perdurantists say about fission cases involving persons; if there's fission, there were two people all

[14] This example and some of the resultant objections pressed by B come from Hughes (1999).

[15] For more on perdurance, see Lewis (1986, p202ff), Effingham (2009), and Sider (1997).

[16] Hughes (1999) suggests this line of reply and then argues that it is not open to the bundle theorist.

along.[17]

B. I see how that could work if one thought there were temporal parts, but you cannot accept both temporal parts and bundle theory.[18]

A. Why not?

B. Well, for a start, universals don't have temporal parts.

A. Why think that?

B. You bundle theorists think that universals—immanent universals—are wholly present in the objects that have them. (After all, if they weren't, then we could individuate bundles by which parts of the universals they had.) If universals had temporal parts, then some of a universal's temporal parts would exist only temporally prior (or posterior) to the existence of (some of) the objects that have them—the instantaneous temporal parts of the material object. And if some of a universal's temporal parts do not temporally overlap with an object, then the universal cannot be wholly present in the object. So, universals do not have temporal parts.[19]

A. I don't see why a *perdurantist* bundle theorist should think that universals are wholly present in the objects that have them in the sense of 'wholly present' you have in mind. Bundle theorists think that universals are often wholly present in more than one place *at a time* (in the sense that, for every universal, each of its temporal parts is wholly present at each place the temporal part is located). But we needn't think they're wholly present at more than one time. After all, we perdurantists don't think that *anything* is wholly present at more than one time. Rather, persisting things have a proper (temporal) part at each time they exist. It is these temporal parts of persisting universals, then, that are wholly present in the objects that instantiate the universals.

But supposing you're right that universals don't have temporal parts, why couldn't a bundle theorist accept that and be a perdurantist about material objects?

B. Because it's impossible that material objects are composed entirely of universals and that material objects have temporal parts. Here's an analogy. It can't be that stars lack temporal parts, that galaxies are composed entirely of stars, and that galaxies have temporal parts.[20]

[17] See, e.g. Lewis (1976).
[18] See Ehring (2001) for an attempt to make *trope* bundle theory consistent with perdurance.
[19] This objection is from Hughes (1999).
[20] Again, this objection and the analogy come from Hughes (1999).

A. Your argument is an instance of an argument form that has other obviously fallacious instances. Consider this one: Universals don't have particulars as parts. Particulars are composed entirely of universals. So it can't be that (some) particulars have particulars as parts. (This parallel is especially apt since temporal parts are particulars.) Clearly something is wrong with these types of arguments. They seem awfully similar to the fallacy of composition.

I take it that the upshot of arguments like yours is that bundle theorists need to accept that, despite the fact that particulars are (ultimately) composed entirely of universals, particulars can come to have parts that are of a different sort than those had by universals. But this shouldn't be all that surprising. Consider an object that is ultimately composed entirely of mereological simples. It can still have proper parts despite the fact that none of the simples that ultimately compose it have proper parts.

B. But I still can't see how a particular could have temporal parts if the universals that compose it do not.

A. Can you see how a particular could have *proper* parts even though the mereological simples that compose it do not?

B. I suppose; otherwise everything would have to be gunky. But there seems to be something different about temporal parts and universals, even though I can't say precisely what it is.

A. Maybe this will help. Consider a chair. The chair is composed of its temporal parts. Each temporal part of the chair is made up of universals. (I would like to say "temporal parts of universals", but even if not?) Thus the chair is made up (ultimately) of universals. Just like a human body is made up of organs, and organs are made up of cells, and thus a human body is ultimately made up of cells.

I think the mistake you are making is a particular instance of a more general one. We should not think that it follows from the fact that objects are ultimately made up of universals that objects are going to be similar to universals in every respect. On the most plausible version of bundle theory, there will still be important metaphysical differences between objects and the universals that make them up.[21]

B. I see. Well, I have another reason that a bundle theorist can't be a perdurantist about material objects if universals *don't* have temporal parts. Suppose a persisting object undergoes no intrinsic change for a few seconds. Each instantaneous temporal part will be a bundle of the same universals. You said, "In order for there to be different objects, there must be a something that differentiates them". These temporal

[21] Here A departs from Paul (2002), who thinks that the bundles of properties are themselves properties. (Paul also thinks that the properties are tropes, whereas A does not.)

parts don't have anything that differentiates them, so they are identical.[22]

A. Oh, that's a good one. I suppose I *could* say that temporal parts are divided based on when an object changes intrinsically—there's not necessarily one for every instant, but one for every distinct bundle.[23] But I'll have to think more about that; it's certainly a departure from the way other perdurantists think about temporal parts.[24] But of course, it doesn't undermine the motivation for perdurantism, which is the problem of temporary intrinsics.[25] That problem arises any time there is intrinsic change.

B. Here is another objection to your conjunction of bundle theory and perdurantism. Take the chair you like talking about. You claim that it's made up of temporal parts, which are themselves made up of universals. Suppose that the chair doesn't change its universals, and let 'chair1' name the temporal part that spans the first half of the chair's life, and 'chair2' the temporal part that spans its second half. How do you account for the difference between chair1 and chair2, given that they share all the same universals?

A. If universals *do* have temporal parts, then chair1 and chair2 are distinct because they're made up of distinct temporal parts of universals.

B. Hold on. Wouldn't two temporal parts of a universal be indiscernible, and thus, for you, identical? In fact, this is another reason that the bundle theorist can't think that universals have temporal parts!

A. If universals have temporal parts, those temporal parts themselves have universals, some of which are universals like *existing at* t, or *existing at* $t2$. So, no two temporal parts of a universal would have all the same universals, and thus they'd be discernible. Temporal parts of material objects have these universals as well.

B. But now you're reifying times! The bundle theorist shouldn't do this, for the same reasons they shouldn't reify places to solve the original two-sphere case. Are times particulars or universals? If they're universals, then what makes them discernible? We're off on a regress. If they're particulars, what are they bundles of?

[22] Thanks to an anonymous referee for posing this objection.

[23] Sider (1997) gives analyses of both instantaneous temporal parts and extended temporal parts. Heller (1993) offers a view of which A's would count as a version, saying that "four dimensionalism is consistent with the view that an object's diachronic identity is a function of that object's temporal parts satisfying a principle of unity", and that "it is consistent with four dimensionalism to say that certain collections of temporal slices compose objects and others do not." Thanks to Dan Korman for drawing our attention to this paper.

[24] See, e.g., Sider (2001, p55).

[25] See Lewis (1986, p202-204).

A. That's a great dilemma. I suppose that if I wanted to go this way, I should think of times as abstract objects, the way many of us think of worlds.

But now I'm thinking that there's a better option than thinking that universals have temporal parts. We can distinguish the temporal parts of objects by their temporal relations to each other—in particular, *earlier-than* and *later-than*. Whereas spatial relations are *all* symmetric because there's no privileged direction, and thus we can't use them to distinguish the two spheres, at least *some* temporal relations are asymmetric because there's a privileged direction. So, that temporal parts of objects stand in the *earlier-than* and *later-than* relations to each other asymmetrically is what makes them discernible.

B. That won't work; you've got a bootstrapping problem. The temporal parts of objects only stand in those relations to each other if they're *already* distinct. Objects aren't earlier than or later than themselves. So if these temporal parts are identical, then they don't stand in those relations. And since they are indiscernible, they are identical.[26]

A. That does seem like a problem. What I said above might help—maybe temporal parts are temporally extended and you get a temporal part only when the object changes. Then there are no distinct but indiscernible temporal parts.

B. There's another problem. Your view is that objects are bundles of universals. Now you're saying that universals are mereological sums of their instantaneous temporal parts. These instantaneous temporal parts of universals don't seem very "universal"—they seem much more like tropes. What distinguishes them from tropes?[27] Is this just a retreat to trope bundle theory?

A. Could I say that objects are bundles of immanent universals, and immanent universals have temporal parts each of which is a trope? Objects and immanent universals are four-dimensional and have temporal parts. Four-dimensional objects are bundles of four-dimensional immanent universals. The temporal parts of immanent universals are tropes, and the temporal parts of objects are bundles of tropes.

B. That's an interesting option. It seems you inherit the theoretical costs of both trope theory and immanent universal theory, but I see no decisive objection against the view. But remember, you still have to deal with the problem that the temporal parts of both objects and immanent universals *must* be discernible. So you'll have to combine this non-standard view with the non-standard view that objects and universals don't

[26] Thanks to an anonymous referee for an objection along these lines.

[27] Thanks to an anonymous referee for this objection.

necessarily have instantaneous temporal parts, but temporal parts are generated by intrinsic change.

A: You've certainly got me on the ropes.

B. Well, let me change tactics, and consider the nature of material objects. Material objects such as spheres are particulars and particulars are just not the kind of thing that can be bi-located. Thus, either bundle theory is false or bundle theory does not entail that material objects can be bi-located.[28] Either way, you cannot appeal to bundle theory to solve the problem.

A. The right way for me to respond depends on how you are construing particulars. Of course, if you stipulate that part of what it is to be a particular is to be a thing that *cannot* be bi-located, then I deny that there are any particulars. But if, as is more standard, 'particular' merely means something like 'material object', then I claim that particulars *can* in fact be bi-located.

B. I do not want to merely stipulate my desired result. I think it follows from the nature of material objects. It may be possible for universals to be multiply located. But this is because universals can be multiply instantiated. Material objects cannot be multiply instantiated (since they are not the kind of thing that can be instantiated at all). And thus, they cannot be multiply located.[29]

A. What if a material object time-travels back to a time at which it existed? Surely then it would be multiply located without being multiply instantiated.

B. That's true. But that's the only way that material objects could be multiply located.

A. That seems *ad hoc*, but I grant that time-travel makes for oddities. In any case, I think you are making the same mistake you made earlier. You assume that what is true for universals must also be true of material objects. On my view, universals are multiply located in virtue of being instantiated in multiple places. (Note that given my acceptance of the bi-location of material objects I cannot say that universals are multiply located just in case they are instantiated in more than one object.) But we need not infer from this that objects must also be instantiated in more than one place if they are to be multiply located. Rather we should say that material objects are multiply located just in case all and only those universals that compose them are instantiated in two separate places.

B. Ok, I see that you are right about that, but now I wonder if we can take your

[28] Vallicella (1997) makes this claim by way of offering a reply to O'Leary-Hawthorne.
[29] For a similar argument, see again Vallicella (1997).

general insight—that bundle theory is not committed to the view that objects and the universals that compose them must function in precisely the same way – and turn it on its head. You claim that (1) universals can be bi-located, and that (2) material objects are bundles of universals. Both of these claims are plausible. But now consider: (3) material objects themselves can be bi-located. This further claim is in my opinion, initially quite implausible. Material objects just do not seem to be the kinds of things that can be bi-located – except by time-traveling. Now initially one might have thought that given (1) and (2), (3) follows straightaway.[30] So the plausibility of (1) and (2) should lead us to accept (3). But now I see that this is far from obvious; just because universals can be bi-located, it need not follow that material objects can be. If material objects can have temporal parts even though universals do not, and if universals can be instantiated even though material objects cannot, then I see no reason to think that, given that universals can be bi-located, it must be possible for material objects to be bi-located.

A. Well maybe (3) does not follow straightaway from bundle theory, but, given that bundle theorists must say something in response to your "two sphere" case, it seems that endorsing (3) is the way to go.

B. That's as may be, but notice that the dialectical situation has now significantly changed. Instead of claiming that the commitments of bundle theory provide you straightaway with a reply to the two-sphere case, you must make an additional claim, and one that many people will find implausible. Again, material objects just don't seem to be the kind of thing that can be wholly located in two separate places!

A. Well I still think (3) will seem less implausible if we take bundle theory seriously.

B. Perhaps less implausible, but implausible nonetheless.

References

Robert Adams. 1979. "Primitive Thisness and Primitive Identity." *The Journal of Philosophy* Vol. LXXVI. No. 1: 5-26.

Andrew Bacon. 2014. "Representing Counterparts." *The Australasian Journal of Logic* Vol. 11. No. 2: 90-113.

Max Black. 1952. "The Identity of Indiscernibles." *Mind* Vol. LXI. No. 242: 153-164.

Nikk Effingham. 2009. "Persistence, Composition and Identity", in *The Routledge Companion to Metaphysics*, ed. Le Poidevin, Simons, McGonigal and Cameron, 296-309. London: Routledge.

[30] O'Leary-Hawthorne (1995) suggests that this inference is obvious.

Douglas Ehring. 2001. "Temporal Parts and Bundle Theory." *Philosophical Studies* 104(2):163-168.
Katherine Hawley. 2009. "Identity and Indiscernibility." *Mind* 118(469): 101-119.
Mark Heller. 1993. "Varieties of four dimensionalism." *Australasian Journal of Philosophy* 71(1): 47-59.
Christopher Hughes. 1999. "Bundle Theory from A to B." *Mind* 108(429):149-156.
David Lewis. 1976. "Survival and Identity", in Amélie O. Rorty (ed.), *The Identities of Persons*, Berkeley: University of California Press, pp. 17-40.
David Lewis. 1979. "Scorekeeping in a Language Game", *Journal of Philosophical Logic* 8.3: 339-359.
David Lewis. 1986. *On the Plurality of Worlds*. Malden: Blackwell.
John O'Leary-Hawthorne. 1995. "The Bundle Theory of Substance and the Identity of Indiscernibles." *Analysis* 55.3: 191-196.
L.A. Paul. 2002. "Logical Parts." *Nous* 36(4):578–596.
Gonzalo Rodriguez-Pereyra. 2004. "The Bundle Theory is Compatible with Distinct but Indiscernible Particulars." *Analysis* 64.1:72-81.
Theodore Sider. 1997. "Four-Dimensionalism", *The Philosophical Review* 106(2): 197-231.
Theodore Sider. 2001. *Four Dimensionalism: An Ontology of Persistence and Time*. Oxford: Clarendon Press.
William F Vallicella. 1997. "Bundles and Indiscernibility: a reply to O'Leary-Hawthorne." *Analysis* 57(1):91-94.
Dean Zimmerman. 1997. "Distinct Indiscernibles and the Bundle Theory." *Mind* 106(422): 305-309.