Locations*

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Think of "locations" very abstractly, as positions in a space, any space. Temporal locations are positions in time; spatial locations are positions in (physical) space; particulars are locations in quality space.

Should we reify locations? Are locations entities? Spatiotemporal *relationalists* say there are no such things as spatiotemporal locations; the fundamental spatial and temporal facts involve no locations as objects, only the instantiation of spatial and temporal relations. The denial of locations in quality space is the *bundle theory*, according to which particulars do not exist; facts apparently about particulars really concern relations between universals.

A "space", in our abstract sense, consists of a set of objects, together with properties and relations defined on those objects. The objects are the locations of the space, and the distribution of the properties and relations over the locations defines the space's structure. All spaces are thus quality spaces; when the relations are thought of as spatiotemporal then the space is also a spatiotemporal space. By not reifying locations one denies that these abstract spaces isomorphically represent the real world. The real world *does* in some sense have a structure that can be non-isomorphically represented by a space (or, more likely, a class of spaces), but the locations in those spaces do not correspond to anything real.

We will examine modal considerations on reifying locations. Denying the existence of spatiotemporal locations excludes certain possibilities for spatiotemporal reality. Denying the existence of qualitative locations excludes certain possibilities for qualitative space. In each case the excluded possibilities are pre-analytically possible. Some of the possibilities can be reinstated by modifying the locationless theories, but at the cost of an unattractive holism.

Do these modal considerations mandate postulating locations? That depends on whether modal intuition can teach us about the actual world. That deep question in the epistemology of modality will not be explored; we merely point out the modal consequences of repudiating locations.

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1. The bundle theory[1]

The traditional formulation of the bundle theory is that particulars are bundles of universals.[2] We will understand the bundle theory more neutrally, as saying that the fundamental facts about qualities involve only universals, and make no reference to particulars. This leaves open whether particulars are to be eliminated from ontology or constructed out of universals, perhaps as sets or fusions of properties and relations. "Bundle theory" is therefore a somewhat misleading name for the position we will be exploring, as our bundle theorist need not put forth bundles as entities.

Our bundle theorist's universals are "sparse", in the sense of not being closed under such operations as negation or disjunction.[3] This is a natural, popular picture, especially if universals are *sui generis* entities, in the ground floor of ontology.

These fundamental facts involving only universals: exactly what form do they take? A careful answer to this question is required before the modal consequences of the bundle theory can be assessed.

Our bundle theorist's ontology contains only universals: properties and relations (each with a fixed, finite -adicy). The theory is *pure* in admitting nothing whatsoever that would play the role of locations in quality space. Thus in addition to lacking particulars, its ontology contains no property instances, tropes, particular events, or any such things.

Its ideology has *compresence* of universals in place of instantiation of universals by particulars.[4] Where we would ordinarily say that a certain particular instantiates properties F, G and H, the bundle theorist says instead that properties F, G and H are compresent (with each other). In the limiting case of a thing having a single property F, the bundle theorist will say simply that F is compresent.

Compresence is *irreducibly plural* and *multigrade*.[5] Irreducibly plural: to say

[1] Our discussion of the bundle theory and spacetime relationalism take as their starting points Cover and Hawthorne (1998) and Sider (2001, chapter 4, section 8), respectively.

[2] See Russell (1940, chapter VI); Russell (1948, p. 83, and part four, chapter VIII).

[3] See Lewis (1986, pp. 59–69).

[4] Russell (1948, part four, chapter VIII) coined the term 'compresence', but gave it a spatiotemporal interpretation and tied it to a phenomenalistic bundle theory. We use 'compresence' rather than 'instantiation' since the latter is usually used in connection with a thing ontology. Whether anything else turns on this traditional distinction is not something we investigate here.

[5] See Cover and Hawthorne (1998, section 3.5).

that F, G and H are compresent is not just to say that any two of F, G and H are pairwise compresent. For suppose, as we would ordinarily say, that some particular is F and G, some other particular is G and H, and a third particular is F and H; but no fourth particular has all three properties. The bundle theorist must say that any two of F, G and H are compresent; if that were all that "F, G and H are compresent" amounted to then it would follow on the bundle theory that the situation is one ordinarily describable as containing a fourth particular with all three properties. Multigrade: it makes sense to say that F_1, …, F_n are compresent, for any finite n.

The account becomes more complicated when relations are introduced. Bundle theorists tend to ignore relations, at best allowing relational properties. But relational properties are complex properties involving the instantiation of relations, and hence rely on a prior account of relations. Our bundle theorist incorporates relations by taking compresence to be multiply plural, in the following sense. For any n-place R, one can say

R is compresent with $(\ldots F^1_i \ldots; \ldots F^2_i \ldots; \ldots; \ldots F^n_i \ldots)$

While this locution is primitive for the bundle theorist, the believer in particulars would regard it as meaning that there exist n particulars, x_1, …, x_n, such that R(x_1, …, x_n), and such that x_1 has the properties F^1_i (i.e., F^1_1, F^1_2, …), x_2 has the properties F^2_i, and so on. The order of the strings "$\ldots F^1_i \ldots$"; "$\ldots F^2_i \ldots$"; …is significant, since this order corresponds to the order in which R holds over x_1, …, x_n, as we would ordinarily say. However, the order in which the properties are mentioned within each string is insignificant. The F^1_i's could equivalently appear as "F, G and H", or "F, H and G", or "G, H, and F", and so on.

Suppose some F bears R to some G, as we would usually say. Thus we have:

F — R — G

The bundle theorist would describe this as a case in which R is compresent with (F; G). A case in which some G bears R to some F would be described as a case in which R is compresent with (G; F). As a final example, consider a situation that, as we would usually say, involves three particulars standing in a three-place relation B; the first particular is F and G, the second is H and I, and the third is J, K and L:

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FG — B — HI
     |
    JKL
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This would be described by the bundle theorist as a case in which

B is compresent with (F and G; H and I; J, K and L).
↑ ↑ ↑ ↑
3-place 3 plural, multigrade slots in which to mention properties

The relation in this case is three-place, so there are three slots in the predication of compresence in which to mention properties. Each of the three slots is plural and multigrade, since in each slot the properties mentioned are said to be collectively compresent, and in each slot any number of monadic properties may be mentioned.

Some will object that understanding the bundle theorist's locutions of compresence requires a prior understanding of the notion of a particular. F and G are said to be compresent in just those cases in which, *as we would normally say*, there exists a particular that has both F and G. If there is no other way to teach the notion of compresence, it will be said, compresence "presupposes" particulars. This objection is misguided. At best it establishes a *conceptual* priority of thing-talk, whereas the issue is ontological. Even if thought is, in the first instance, of things, the world may yet at bottom contain nothing but universals.

Thus, the bundle theorist aims to describe the world speaking only of the compresence of universals. She may later introduce fusions of properties and relations ("bundles"), but predications of compresence may not mention these bundles. The fundamental facts are all and only those expressible with predications of compresence mentioning only universals.

2. The bundle theory and possibility

The bundle theory, we take it, is put forward as a necessary truth.[6] Therefore, a possibility for the world may be specified by specifying which predications of compresence are true at it. It follows that there cannot exist distinct possibilities in which all the same predications of compresence are true.[7] This, we will see, imposes a severe restriction on what is possible.

[6] This could be denied — see Cover and Hawthorne (1998, section 4).

[7] This is not to assume any strong combinatorial principle of possibility. Combinatorialism claims that all combinations of "metaphysical elements" are possible, whereas we assume only that all possibilities are combinations of metaphysical elements. This also does not assume the existence of "negative" facts: a predication of compresence failing to hold does not require the existence of a "truth-maker" for that failure.

The classic bundle theory is generally thought to preclude the possibility of distinct indiscernible particulars, which would be identified with the same bundle of universals and so with each other.[8] While our bundle theory does not reify bundles, it nevertheless implies a corresponding restriction on possibilities involving what we would normally describe as qualitatively indiscernible particulars. Consider two possible worlds, one containing just a single thing with property F, the other containing two things with property F. In neither world is any relation instantiated. The bundle theorist's description of each world will be the same: F is compresent. Therefore the bundle theorist cannot admit that these possibilities are genuinely distinct.

Consider two other possible worlds, like those just considered except that a certain binary relation, R, is instantiated in each world. In the first world the sole particular bears R to itself, whereas in the second world the two particulars bear R to each other:

$$w_1\!: \underset{\underset{\mathrm{R}}{\circlearrowleft}}{\bullet}\ \mathrm{F} \qquad\qquad\qquad w_2\!: \underset{\mathrm{F}}{\bullet} \leftarrow \mathrm{R} \rightarrow \underset{\mathrm{F}}{\bullet}$$

Again, the bundle theorist cannot distinguish the worlds, for in each case the description will be the same: R is compresent with (F; F). Similarly, neither world can be distinguished from any world with any number of F-things, each bearing R to all the rest.

The traditional objection is often put this way: "the bundle theory cannot allow a world with nothing but two distinct indiscernible particulars". Strictly speaking, our bundle theorist does not allow worlds with *any* particulars; but consider the objection that the bundle theorist cannot allow worlds we would normally describe as having two distinct indiscernible particulars. This objection is not quite right, for the bundle theorist's description "R is compresent with (F; F)" is in a sense the bundle theorist's substitute for indiscernible particulars. The real objection is that this description does not distinguish indiscernible particulars standing in R from a single particular bearing R to itself — it does not distinguish world w_1 from world w_2.

The bundle theorist might stick to her guns and argue that w_1 and w_2 are not genuinely distinct. Let R be the relation **being five feet from**. In an earlier publication (Hawthorne, 1995), one of us suggested the reply that the

[8] See Russell (1940, p. 120, 127); Black (1952) (who does not consider the bundle theory explicitly, only the identity of indiscernibles); Armstrong (1978, chapter 9, section 1); Van Cleve (1985).

possibility one would ordinarily call two distinct F-things standing in R is in fact the possibility of F being five feet from itself. The sentence "there are two F-things five feet apart" is made true, on this view, by facts about universals — by F's being five feet from itself.[9] This reply only addresses the objection that the bundle theory precludes the possibility of indiscernible particulars, whereas the present objection is that worlds w_1 and w_2 cannot be distinguished by the bundle theorist. But the reply could be extended: we are mistaken in thinking that possibilities w_1 and w_2 are distinct; modal intuition is sufficiently satisfied by admitting just the single possibility of R being compresent with (F; F). Against this reply the determined objector must continue to insist that her modal intuitions clearly specify that w_1 and w_2 are distinct possibilities, that there is a difference between a single particular being five feet from itself and distinct particulars being separated by five feet.

That the bundle theory runs into trouble with indiscernible particulars is well-known. But in fact, many other pre-analytically distinct possibilities are identified by the bundle theorist. Consider:

w_3: F—R—G—R—H $\qquad\qquad$ w_4: F—R—G $\quad$ G—R—H

In w_3, an F bears R to a G, which in turn bears R to an H. In w_4, F bears R to a G, and a distinct G bears R to an H. These possibilities are identified by the bundle theorist, for the same predications of compresence hold in each case: "R is compresent with (F; G)", and "R is compresent with (G; H)".

Or consider two apparently distinct cases involving two particulars each of which has the property F. In the first, binary relations R and S hold between the particulars in the same direction, whereas in the second case they hold in opposite directions:

$$\mathrm{F} \overset{\mathrm{R}}{\underset{\mathrm{S}}{\rightrightarrows}} \mathrm{F} \qquad\qquad \mathrm{F} \overset{\mathrm{R}}{\underset{\mathrm{S}}{\rightleftarrows}} \mathrm{F}$$

In each case the bundle theorist has the same two predications of compresence: "R is compresent with (F; F)", and "S is compresent with (F; F)".

Neither case involves indiscernible particulars; the problem is different from the traditional one. The bundle theorist could dig in her heels yet again. But

[9] Compare also Van Cleve (1985, p. 104). But his version of the response presupposes substantivalism about places (see his note 30).

identifying these possibilities would involve a massive departure from ordinary modal belief.

Each case involves a failure of "linkage" between distinct facts of compresence. In describing w_3 the bundle theorist says that R is compresent with (F; G), and then goes on to say that R is compresent with (G; H); but this leaves out that it is the very same G-thing mentioned in the first statement that bears R to the H-thing mentioned in the second statement. Of course, the bundle theorist cannot say precisely this, since she does not believe in G-*things*. The question is whether predications of compresence can be linked in some legitimate way.

The bundle theorist might further complicate the notion of compresence. In describing w_3, rather than making two separate statements:

> R is compresent with (F; G). R is compresent with (G; H).

she might substitute a single statement:

> (*) R is compresent with (F; G), the latter of which is such that R is compresent with (it; H)

(*) is *not* a mere abbreviation for the first statement, which is true in both w_3 and w_4; (*) is to be true only in w_3.

In (*), the phrase "the latter of which" does not merely refer to G; its function is to associate two positions within a single complex sentence form, namely the position occupied by 'G' and the position occupied by 'it'. One could further emphasize this by dropping the second occurrence of 'is compresent with', as this suggests that a second separable attribution of compresence is being made; the form of (*) could then be thought of as the following:

$$\text{compresence}(R_1,F_1,F_2,R_2,F_3)$$

In sentence (*), R_1 was R, F_1 was F, F_2 was G, R_2 was R, and F_3 was H; thus (*) is "compresence(R,F,G,R,H)". The fact that the two places in (*) concerning G are associated is emphasized here by the existence of only a single slot that G occupies (slot F_2) — there are no two slots that could potentially be filled by distinct property names. And though it may appear that (*) speaks of *cases* of G, which could only be particulars (or tropes, or property-instances, or something else playing the role of locations in quality space), in fact (*) is a complex statement about only R, F, G and H, true in exactly those cases in which we would ordinarily say that an F-thing bears R to a G-thing, which in turn bears R to an H-thing.

As for the pair of cases involving R and S holding between two F-things, in the same direction in one case but opposite directions in the other, in the first the bundle theorist would say:

> R is compresent with (F; F), the latter of which is such that S is compresent with (it; F)

whereas in the second she would say:

> R is compresent with (F; F), the latter of which is such that S is compresent with (F; it)

Each of these statements is an instance of a different irreducible form of attribution of compresence, for different "positions" are associated in the two cases. Moreover, each has a form quite different from (*).

Let us explore the bundle theorist's introduction of linkage more carefully. The initial bundle theory invoked the compresence locution:

> R is compresent with ($\ldots\mathrm{F}^1_i\ldots$; $\ldots\mathrm{F}^2_i\ldots$; …; $\ldots\mathrm{F}^n_i\ldots$)

which was to be true in cases in which, as we would ordinarily say:

> there exist n particulars, $x_1, \ldots, x_n$, such that $\mathrm{R}(x_1, \ldots, x_n)$, and such that x_1 has the F^1_is, x_2 has the F^2_is, …, x_n has the F^n_is.

But mere conjunctions (or lists) of such attributions do not allow the expression of linkage. The conjunctive sentence:

> R is compresent with ($\ldots\mathrm{F}^1_i\ldots$; $\ldots\mathrm{F}^2_i\ldots$; …; $\ldots\mathrm{F}^n_i\ldots$) & R′ is compresent with ($\ldots\mathrm{G}^1_i\ldots$; $\ldots\mathrm{G}^2_i\ldots$; …; $\ldots\mathrm{G}^m_i\ldots$)

will be true in just those cases in which, as we would ordinarily say:

> there exist n particulars, $x_1, \ldots, x_n$, such that $\mathrm{R}(x_1, \ldots, x_n)$, and such that x_1 has the F^1_is, x_2 has the F^2_is,…, x_n has the F^n_is
>
> &
>
> there exist m particulars, $y_1, \ldots, y_m$, such that $\mathrm{R}'(y_1, \ldots, y_m)$, and such that y_1 has the G^1_is, y_2 has the G^2_is,…, y_m has the G^m_is.

The existentially quantified variables x_i associated with the first compresence conjunct are different from those variables y_j associated with the second; that is what disallows the expression of linkage. Linkage would be expressed if, in place of some of the variables y_j we could instead write one of the variables x_i. One might, for example, want to link the position occupied by x_1 in the first conjunct with the position occupied by y_1 in the second:

> there exist n particulars, $x_1, \ldots, x_n$, such that $R(x_1, \ldots, x_n)$, and such that x_1 has the F^1_is, x_2 has the F^2_is,…, x_n has the F^n_is
>
> &
>
> there exist ***m-1*** particulars, $y_2, \ldots, y_m$, such that $R'(\boldsymbol{x}_1, y_2, \ldots, y_m)$, and such that y_2 has the G^2_is,…, y_m has the G^m_is.

To get this effect, the bundle theorist needs an attribution of compresence that is true just when, as we would ordinarily say, this last statement is true. The needed attribution can be symbolized thus:

> R is compresent with $(\ldots F^1_i \ldots|\alpha;\ \ldots F^2_i \ldots;\ \ldots;\ \ldots F^n_i \ldots)$; R is compresent with $(\alpha;\ \ldots G^2_i \ldots;\ \ldots;\ \ldots G^m_i \ldots)$

The presence of the symbol $|\alpha$ after the F^1_is, and the presence of α in place of the G^1_is, indicates that those positions are to be linked. In this case only one position is linked, and so we could say more informally (as we did with (*) above):

> R is compresent with $(\ldots F^1_i \ldots;\ \ldots F^2_i \ldots;\ \ldots;\ \ldots F^n_i \ldots)$, the first of which is such that R is compresent with (it; $\ldots G^2_i \ldots;\ \ldots;\ \ldots G^m_i \ldots)$

But in the general case we need the symbols α, β, etc., for clarity.[10] One might, for example, want to link quite a few positions in a pair of attributions of compresence. For definiteness sake, let R have three places, let R′ have four, and consider the following example:

> R is compresent with $(\ldots F^1_i \ldots|\alpha;\ \ldots F^2_i \ldots|\beta;\ \ldots F^3_i \ldots|\gamma)$; R′ is compresent with $(\alpha;\ \beta;\ \gamma;\ \ldots G_i \ldots)$

[10] Note that α, β, etc., are not variables standing for entities; they are syntactic devices for associating certain positions within attributions of compresence.

This sentence would be true in cases in which, as we would ordinarily say:

> there exist 3 particulars, x_1, x_2, x_3, such that R(x_1, x_2, x_3), and such that x_1 has the F^1_is, x_2 has the F^2_is, x_3 has the F^3_is
>
> &
>
> there exists a particular, y, such that R′(x_1,x_2,x_3,y), and such that y has the G_is.

Still more generally, the bundle theorist will want to allow linkages between more than two attributions of compresence, for example:

> R is compresent with (F and G|α; H and I); R′ is compresent with (J|β; α; K, L and M); R″ is compresent with (β; α; N and O)

which would be true in just those circumstances in which, as we would ordinarily say:

> there exist two particulars, x_1 and x_2, such that R(x_1,x_2), Fx_1, Gx_1, Hx_2, and Ix_2
>
> &
>
> there exist two particulars y_1 and y_2, such that R′(y_1,x_1,y_2), Jy_1, Ky_2, Ly_2, and My_2
>
> &
>
> there exists a particular, z, such that R″(y_1,x_1,z), Nz and Oz

Moreover, linkages should be allowed within a single attribution of compresence, as in:

> R is compresent with (F and G|α; H and I; α)

which would be true in cases in which, as we would ordinarily say, there exist particulars x and y, such that R(x,y,x), Fx, Gx, Hy and Iy.

Call any sentence of the following form a *pure Ramsey sentence*:

> There exist particulars x_1, …, x_n such that ϕ_1 & …& ϕ_m

where each ϕ_i attributes some universal (perhaps a property, perhaps a relation) to some of the variables $x_1, \ldots, x_n$, and in which repetition of variables between and within the ϕ_is is allowed. (Note that this definition disallows the presence of negation symbols.) What we have seen is that for any pure Ramsey sentence, S, our revised bundle theory allows a sentence concerning the compresence of universals that is true in just those cases in which, as we would ordinarily say, S is true.

By allowing linkage within a single statement of compresence, our bundle theorist can now distinguish worlds w_1 and w_2 above:

$$w_1: \begin{tikzcd} \bullet \arrow[loop below, "R"] & F \end{tikzcd} \qquad\qquad w_2: \begin{tikzcd} \bullet & R \arrow[l] \arrow[r] & \bullet \\ F & & F \end{tikzcd}$$

Only in w_1 is it true that R is compresent with (F|α; α), for only in w_1 is it true that, as we would ordinarily say, something bears R to itself. It might be surprising that the new bundle theory can distinguish w_1 and w_2, since the failure to allow distinctions between indiscernible objects is usually thought to be a defining feature of the bundle theory. But distinguishing these worlds is a natural extension of allowing the linkage one needs to distinguish between worlds like w_3 and w_4.[11] Moreover, if the example is changed so that each object in w_2 bears R to itself, the worlds can no longer be distinguished:[12]

$$w_{1a}: \begin{tikzcd} \bullet \arrow[loop below, "R"] & F \end{tikzcd} \qquad\qquad w_{2a}: \begin{tikzcd} F & & F \\ \bullet \arrow[loop below, "R"] & R \arrow[l] \arrow[r] & \bullet \arrow[loop below, "R"] \end{tikzcd}$$

[11]What if, despite this, the bundle theorist shies away from distinguishing w_1 and w_2, on the grounds that this smacks of belief in particulars, but still wants to invoke linkage to distinguish w_3 and w_4? She might claim that sometimes differences in claims of linkage correspond to no genuine ontological difference. She might, for example, claim that "R is compresent with (F|α; α)" and "R is compresent with (F; F)" are, as it happens, true in exactly the same possible circumstances. Such a bundle theorist ought to give a principled account of *which* differences in statements of linkage correspond to distinct possibilities, since, on her view, some do and some do not. We will not explore the issue further.

[12]A similar example: given linkage, the bundle theorist can distinguish a world containing (as we would usually say) a pair of indiscernible spheres separated by one foot from a world containing a single bi-located duplicate sphere that is located one foot from itself; for only in the second world is it true that **being one foot from** is compresent with (spherehood|α,α). However, even linkage will not distinguish this second world from a world containing *two* bi-located duplicate spheres, each located one foot from itself, each located in exactly the same places as the other.

Thus, even the new bundle theory collapses certain possibilities involving indiscernible things.

One *could* modify the bundle theory even more, to distinguish even these possibilities. Imagine, in addition to the $|\alpha$ notation for linkage, adding notation for *anti-linkage*. Let:

R is compresent with (F$|\not\alpha$;G); R is compresent with (H$|\not\alpha$,I)

be used in cases in which, as we would ordinarily say, there exists an x_1 and x_2, such that R(x_1,x_2), Fx_1, and Gx_2, and there exists a y_1 and y_2, such that $\boldsymbol{y_1}$ **is distinct from** $\boldsymbol{x_1}$, R(y_1,y_2), Hy_1, and Iy_2. Marking two property-slots with $|\not\alpha$ signifies, as we would normally say, *distinct* particulars that have the properties in question. Worlds w_{1a} and w_{2a} can now be distinguished: only in w_{2a} is it true that R is compresent with (F$|\not\alpha$; F$|\not\alpha$), for only in w_{2a} is there, as we would normally say, an F that bears R to a *distinct* F. In addition to capturing the content of what we normally express with pure Ramsey sentences, this doubly modified bundle theory captures the content of what we normally express with *impure Ramsey sentences*, which are like pure Ramsey sentences except that information about the numerical distinctness of the values of the variables may be added.[13]

Some might charge this doubly modified bundle theory of being the theory of particulars in disguise. This charge is to some degree unjustified since a believer in particulars is free to distinguish possibilities that share the same impure Ramsey sentences. The view that such possibilities can indeed be distinguished is sometimes called haecceitism[14], and is not open to the doubly modified bundle theorist. Moreover, the doubly modified bundle theorist may insist that she does not believe in particulars, even though her beliefs about what is possible are isomorphic to those of the genuine believer in particulars. Still, some may remain alarmed at how close the modified bundle theorist has moved to believing in particulars. The question then becomes whether there is any principled reason to allow linkage and then stop, without going on to allow anti-linkage as well. If not, then so much the worse for the bundle theorist! — she can neither live with linkage (since that draws her too close to belief in particulars) nor live without it (since that violates too many ordinary modal intuitions). But we think that a bundle theory that allows linkage while

[13]If *all* impure Ramsey sentences are to be captured, a separate mechanism would be needed for expressing anti-linkage in statements of compresence that involve no relations.

[14]See Lewis (1986, section 4.4).

disallowing anti-linkage is a reasonably motivated middle ground; it is that bundle theory we consider henceforth.

Allowing linkage is attractive for its modal consequences. But there is a serious cost. By admitting that sentences like (*) do not reduce to simpler predications of compresence, the bundle theorist adopts a sort of holism. Whenever there is a network of interrelated things, the facts cannot be captured by anything simpler than a single statement describing the entire organic whole. Suppose an F bears R to some G, which in turn bears S to something else with G, H and I; suppose the F-thing stands in a three place relation to a G-thing and an H-thing, each of which bear relation R to …. A new irreducible, complex locution of compresence will be needed to describe this entire situation. Any series of statements describing mere parts of the system will leave out the linkages expressed by locutions like "the F-thing". One is reminded of the 19$^{\text{th}}$ century British idealists, who denied that the truth about the world could be broken down into facts about the world's components.

Indeed, the original bundle theory, which attributed relations with statements like "Relation R is compresent with (F and G; H and I)", already implied a limited holism. The holding of relations could not be attributed without specifying the properties of the things related. The totality of facts of a given case of R's holding could not be specified by anything other than a single statement mentioning all the monadic properties of R's *relata*. Moreover, the irreducibly plural nature of compresence is the source of more holism: the compresence of multiple properties does not reduce to pairwise compresence between properties taken two at a time.

Holism can be avoided if one accepts locations, in this case particulars, for locations provide linkages between distinct facts. This is the *raison d'être* of locations. When we say "particular a is F, and bears relation R to particular b, which is G", and later go on to say that "b bears relation R to particular c, which is H", the two facts expressed are linked by the recurrence of the name 'b' — we thereby say that the very same case of G mentioned in the first fact is related by R to a case of H.

What, exactly, is the worry about "holism"? Holism, we have said, is a failure of complex truths to reduce to simpler truths. By 'reduce' we do not mean translation; everyone should agree that '$\forall x Fx$' does not translate any conjunction of simple subject-predicate sentences. We mean instead supervenience: complex truths ought to supervene on simpler truths. By "complex" and "simpler" truths we mean (what we would ordinarily describe as) truths about complex and simpler systems of objects. Thus, truths about a set of objects should supervene on truths about the properties and relations of subsets of that set. But this in turn requires clarification, for the holding of an n-place relation over n objects will not in general supervene on facts about subsets of those n objects. The objectionable holism implied by the modified bundle theory is that *no matter what the basic properties and relations are, truths about what intuitively count as complex systems involving just those properties and relations do not supervene on simple statements attributing the instantiation of those properties and relations*. To capture the linkages in complex systems involving a chosen set of basic properties and relations, complex statements that fail to supervene on simpler ones must be introduced. This is the neo-Hegelian holism we reject, or at least ridicule.[15]

Related to holism is an explosion of ideology. The modified bundle theory appeals to an infinite number of primitive locutions concerning compresence, for example:

> R is compresent with (F; G)
>
> R is compresent with (F; G$|\alpha$); S is compresent with (α; H)
>
> R is compresent with (F$|\alpha$; G); S is compresent with (α; H)
>
> R is compresent with (F; G$|\alpha$); S is compresent with (H; α)
>
> R is compresent with (F; G$|\alpha$); S is compresent with (α; H$|\beta$); R is compresent with (β; F)
>
> etc.

Each is an irreducible form, in the sense that the more complex forms are never definable in terms of the simpler ones. Thus, the re-use of the term 'compresence' in each is a bit of a cheat. Rather than containing a single notion of compresence, the primitive ideology of the bundle theorist now contains infinitely many locutions, each of which can be used to make a different sort of statement about universals.[16]

The burden could be shifted from ideology to ontology. Instead of saying:

[15]This holism also implies modal connections some might find strange. Necessarily, if (*) is true then R must be compresent with F and G (likewise, it is necessary that if (*) is true then R is compresent with G and H.) Thanks to Dean Zimmerman for this observation.

[16] Might one regard each locution as involving a single highly flexible bit of ideology? Such a notion would be "multigrade" in a very generalized way. One's sense of how to count bits of ideology breaks down. Alternatively, finitude might be restored using something like Quine's (1960) tricks for eliminating variables from quantification theory. Regardless of the relative merits of such an ideology, holism remains.

R is compresent with (F; G|α); S is compresent with (α; H)

one could introduce a new relation, **T**, intuitively described as the relation holding between particulars x, y, z iff x and y stand in R and y and z stand in S; one could then say:

T is compresent with (F; G; H)

The complexities in ideology could be avoided if such complex relations were generally postulated. Whether or not this trade of ontology for ideology is significant, it does nothing to avoid holism, for the new relations remain irreducible to simpler relations. Further, despite this irreducibility, the instantiation of the new relations necessarily implies the instantiation of simpler relations. **T**'s being compresent with (F; G; H) would necessarily imply, for example, that R is compresent with (F; G). Finally, one should not be too quick to trust these new relations, for they are not the ordinary "complex relations" we all know and love. The instantiation of what one normally thinks of as a complex relation is just a matter of the instantiation of its "constituents", whereas these new relations do not supervene on their constituents.

Set aside complex relations, and return to the theory that adds new locutions of compresence to ideology. Even with these additions, the bundle theory still threatens to preclude some possibilities involving infinitely many individuals.[17] Consider two cases, each involving an infinite series of F-things, each of which stands in a certain relation R to the adjacent members in the series but nothing else. The first infinite series has a beginning — a first thing that is F, as we would ordinarily say — but no end, whereas the second series is two-way, with neither a beginning nor an end:

One-way infinite series: F-R-F-R-F-R-F-R-F-…

Two-way infinite series: …-F-R-F-R-F-R-F-R-F-…

In each case the same finite predications of compresence are true:[18]

[17] Moreover, the examples we consider involve discrete infinities; we do not here consider the even more complex matter of how the bundle theorist will describe continuous infinite structures, for example space.

[18] We continue to assume a sparse conception of universals.

R is compresent with (F; F)

R is compresent with (F; F|α); R is compresent with (α; F)

R is compresent with (F; F|α); R is compresent with (α; F|β); R is compresent with (β; F)

etc.

So the possibilities apparently cannot be distinguished. However, the bundle theorist might be willing to allow infinite predications of compresence, in which case the possibilities could be distinguished after all. The following would hold in the two-way series but not in the one-way series:

…R is compresent with (α_{-1}; F|α_0); R is compresent with (α_0; F|α_1); R is compresent with (α_1; F|α_2); …

This sentence involves a two-way infinite primitive locution of compresence, which is irreducible to finite locutions. Appealing to this locution implies more holism and bloats ideology, but at least it distinguishes possibilities that ought to be distinguished.[19]

Our discussion of the bundle theory has been very abstract. We described possibilities schematically, as involving universals "F", "G", "R", etc., without specifying what those universals were. But a certain sort of bundle theorist would hold that our thinking about possibilities is tied to specific universals: spatiotemporal relations. According to this view, which we may call "spatiotemporalism", the world is essentially spatiotemporal. Moreover, spatiotemporal relations are essentially *pervasive*, in that the world is necessarily a single spatiotemporal structure in which everything (as we would normally say) stands in spatiotemporal relations to everything else. Moreover, our modal intuitions are essentially intuitions about these spatiotemporal structures.[20]

[19] Consider the following pair of worlds, in neither of which is any relation instantiated. The first contains (as we would ordinarily say) an infinite series of objects, the first of which has property F_1, the second of which has F_1 and F_2, the third of which has F_1, F_2, and F_3, and so on. The second contains just a single object that has infinitely many properties: F_1, F_2, F_3, …This is another case showing the need for infinitary locutions: to distinguish these worlds we need the infinitary sentence "F_1, F_2, …are compresent with each other".

[20] Suppose the spatiotemporalist admitted no primitive relations other than spatiotemporal ones. Then compresence could be replaced in ideology with spatiotemporal locutions, and spatiotemporal relations could be dropped from ontology. Instead of saying "**being five feet from** is compresent with (F, G and H; I, J and K)", one would say instead "F, G and H are five

Spatiotemporalism appears, initially anyway, to allow the bundle theorist to do without linkage, and thus avoid holism. Recall the first argument for linkage. Worlds w_3 and w_4 were not distinguished by our original bundle theorist:

$$w_3\text{: F—R—G—R—H} \qquad\qquad w_4\text{: F—R—G} \quad \text{G—R—H}$$

Each world was to be ordinarily describable as containing an F-thing, a, standing in R to a G-thing, b, and a G-thing, c, standing in R to an H-thing, d; the difference was that the G-things, b and c, are identical in w_3 but not in w_4. But if R is a spatiotemporal relation, then, the spatiotemporalist will claim, *additional* spatiotemporal relations will distinguish the worlds. Since b c in w_4, b and c must be at different spatiotemporal locations, which will generate differences from w_3. For concreteness sake, let R be the spatial relation **being five feet from**, and suppose the objects are linearly arranged as follows (ignoring time):

$$\begin{array}{llll} w_{3a}\text{:} & \text{F} & \text{G} & \text{H} \\ & a & b & d \\ & \multicolumn{3}{l}{|\!\leftarrow 5' \rightarrow\!|\!\leftarrow 5' \rightarrow\!|} \end{array} \qquad\qquad \begin{array}{lllll} w_{4a}\text{:} & \text{F} & \text{G} & \text{G} & \text{H} \\ & a & b & c & d \\ & \multicolumn{4}{l}{|\!\leftarrow 5' \rightarrow\!|\!\leftarrow 5' \rightarrow\!|\!\leftarrow 5' \rightarrow\!|} \end{array}$$

Then it will be true only in w_{3a} that **being ten feet from** is compresent with (F; H), and it will be true only in w_{4a} that **being fifteen feet from** is compresent with (F; H). The spatiotemporalist thus claims that if R in the abstract descriptions of w_3 and w_4 is a spatial relation, then the worlds are impossible since spatial relations are pervasive. It cannot be that *only* R holds in these cases; other spatial relations *must* hold. Once this is taken into account, w_3 and w_4 become w_{3a} and w_{4a}, which can be distinguished.

At first glance, spatiotemporalism does not answer the objection when R is not spatiotemporal. Let R in w_3 and w_4 be a relation that is not pervasive in the way spatiotemporal relations are. The spatiotemporalist will insist that *some* spatiotemporal relations must hold. If the worlds are to remain indistinguishable by the bundle theorist then the same facts of compresence involving spatiotemporal relations must hold. Since b and c are identical in w_3,

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feet from I, J and K". Cover and O'Leary-Hawthorne (1998) defend spatiotemporalism but take yet another approach: they drop compresence from ideology in favor of instantiation, and say that properties instantiate spatiotemporal relations (and perhaps a select few others, such as nomic necessitation).

they must be spatiotemporally indistinguishable from each other in w_4; this may be achieved by letting them be spatiotemporally coincident. The resulting worlds, call them w_{3b} and w_{4b}, cannot be distinguished. For concreteness sake: suppose that in w_{3b}, a is F and is five feet from and bears relation R to b, which is G; then another five feet in the same direction we have another object, d, which is H, and such that b bears R to d. In w_{4b}, a is F and is five feet from and bears R to b, which is G; but in exactly the same place as b there is another G-thing, c. Object d is located exactly as before, and is H as before; but now it is c that bears R to d; b does *not* bear R to d:

$$w_{3b}\!: \begin{array}{l} \mathrm{F} \qquad \mathrm{G} \qquad \mathrm{H} \\ a \text{ - R - } b \text{ - R - } d \\ |\!\leftarrow 5' \rightarrow\!|\!\leftarrow 5' \rightarrow\!| \end{array} \qquad\qquad w_{4b}\!: \begin{array}{l} \mathrm{F} \qquad \mathrm{G} \qquad \mathrm{H} \\ a \text{ - R - } \underset{\neq c}{b} \text{ - R- } d \\ |\!\leftarrow 5' \rightarrow\!|\!\leftarrow 5' \rightarrow\!| \end{array}$$

These worlds cannot be distinguished, for the facts of compresence involving spatial relations are the same in the two worlds, and in each case, R is compresent with (F; G), and R is compresent with (G; H). Pressure towards complex locutions like (*), and thus towards holism, has apparently returned.

But it would be in the spirit of spatiotemporalism to reject any genuine difference between these worlds. Since our concept of possibility is inherently spatiotemporal, and w_{3b} and w_{4b} have the same spatiotemporal distribution of universals (in some suitable sense), they are not genuinely different possibilities.

Thus, some of the bundle theory's restrictions on possibility can be accepted, and some holism thereby avoided. The limitation of possibilities to spatiotemporal possibilities will seem overly narrow to some, but at least the limitation is principled. However, other cases reintroduce the need for linkage. First, recall a case considered above:

$$\mathrm{F} \;\begin{array}{c} \overset{\mathrm{R}}{\rightarrow} \\ \underset{\mathrm{S}}{\rightarrow} \end{array}\; \mathrm{F} \qquad\qquad \mathrm{F} \;\begin{array}{c} \overset{\mathrm{R}}{\rightarrow} \\ \underset{\mathrm{S}}{\leftarrow} \end{array}\; \mathrm{F}$$

In each case R and S hold between, as we would ordinarily say, a pair of objects that are F; in the first they hold in the same direction whereas in the second they hold in opposite directions. We pointed out that the cases have the same description: in each R is compresent with (F; F), and S is compresent with (F; F). To make the example acceptable to the spatiotemporalist, the cases must become spatiotemporal; so let the Fs in each case be spatiotemporally similar (separated by one foot in each case, say). Let R and S be non-spatiotemporal relations, holding as before. Then the cases still have the same description, but nevertheless seem distinct (even the spatiotemporalist ought to admit this, since the cases involve different spatiotemporal distributions of R and S).[21] The spatiotemporalist might be willing to reject the existence of R and S, perhaps by making the very strong claim that there can be no polyadic universals other than the spatiotemporal ones. Otherwise even the spatiotemporalist needs linkage.

Second, consider two cases, each involving an infinite line of F-things spaced evenly five feet apart. In the first case the line has a beginning whereas in the second the line is infinite in each direction. These in essence are the cases considered above:

> One-way infinite series: F-R-F-R-F-R-F-R-F-…
>
> Two-way infinite series: …-F-R-F-R-F-R-F-R-F-…

in which relation R is taken to be **being five feet from**. The spatiotemporalist has no principled reason to refuse to distinguish these cases since they involve distinct spatiotemporal structures. But they share the same facts of compresence. In each case we have "**being five feet from** is compresent with (F; F)", "**being ten feet from** is compresent with (F; F)", and so on. The spatiotemporalist then faces the same choices as the bundle theorist: live with an unintuitive limitation on possibility, or accept linkage, and so holism.

3. Space-time relationalism

Spacetime relationalists deny the existence of spatiotemporal locations (or perhaps say that spatiotemporal locations are constructs of some sort, as opposed to *sui generis entities*). We will discuss a *pure* relationalist, who admits nothing whatsoever playing the role of spacetime locations. Not only are *points* renounced; other spatiotemporally local entities such as temporal parts (whether

[21] Another example, this time involving symmetric relations; let each of the following cases involve three Fs spatially arranged in the same way:

$$F \overset{R}{\longleftrightarrow} F \overset{S}{\longleftrightarrow} F \qquad\qquad\qquad F \;\substack{\overset{R}{\longleftrightarrow} \\ \underset{S}{\longleftrightarrow}}\; F \qquad F$$

arbitrarily small or instantaneous), events, and the like, are renounced as well. An especially pure spatiotemporal relationalist would not even admit *spatially* local entities, and so would reject the existence of arbitrarily small or point-like spatial parts. The world would thus contain spatially as well as temporally extended mereological atoms. Our relationalist is only temporally pure: while temporal parts are prohibited, spatial parts are allowed. (Discussion of the spatially and temporally pure relationalist would parallel what follows, but we will focus on a view more similar to currently popular views.)

Relationalism must be formulated precisely. The relationalist's ontology has no spacetime points, only enduring particulars — entities with no temporal parts — and properties and relations. (We do not here explore the combination of spacetime relationalism with the bundle theory.) The relationalist's ideology requires extensive discussion. The temporal facts must be described without invoking temporal locations. These temporal facts concern i) qualitative change and ii) relative temporal location.

Most who reject spacetime points have an easier time than our relationalist, for though they reject one sort of spatiotemporally local entity, they accept another: temporal parts.[22] Given temporal parts, the facts about relative temporal location emerge from the holding of binary temporal relations between temporal parts, relations such as **simultaneity** and **being *n* units after** for various n (we ignore the theory of relativity throughout). Enduring objects have temporal extent, and so stand in more complex temporal relations. Suppose one enduring object lasts from 1950–1970, whereas another lasts from 1960–1965; are the two objects simultaneous? Is one after the other? Neither description seems quite right: a new vocabulary is called for.[23]

Given temporal parts, the facts about qualitative change emerge from the intrinsic properties instantiated by the temporal parts of continuing things. A person changes from being short to being tall by having an earlier temporal part that instantiates **shortness** and a later one that instantiates **tallness**.[24] Those who reject temporal parts usually say instead that the person instantiates

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[22] See Friedman (1983, chapter VI) and Mundy (1983). Even Leibniz does not count as a pure temporal relationalist, given his acceptance of accidents.

[23] See Russell's (1914, pp. 122–127) temporal relationalism based on non-instantaneous temporal relata. Russell's relata — events — have temporal parts, which makes his task easier than the pure relationalist's.

[24] This presupposes the usual view that continuants are aggregates of temporal parts, but see Sider (1996, 2001, chapter 5).

shortness *at* one time while instantiating **tallness** *at* a later time.[25] But this talk of instantiation *at* times presupposes the existence of times. Our relationalist accepts neither temporal parts nor times, and so can make use of neither strategy for characterizing change.

The following strategy solves both problems at once. The usual notion of instantiation is expressed this way, given temporal parts:

> x instantiates property F
>
> x and y instantiate relation R

or this way, if temporal parts are rejected:

x instantiates property F at t	
x and y instantiate relation R at t	(single-time relation)
x and y instantiate relation R at t, t'	(cross time relation — "x as it is at t bears R to y as it is at t'")

Instead, let the relationalist's ideology include notions expressed thus:

x instantiates F n units of time after/before y instantiates G	
x instantiates F n units of time after/before y and z stand in R	(single-time relation)
x bears R to y n units of time hence/earlier	(cross-time relation)

These locutions are primitive, but may be clarified by saying how a substantivalist would interpret them:[26]

> x instantiates F n units of time after/before y instantiates G:
>
>> There exist times, t and t', such that t' is n units of time after/before t, x instantiates F at t', and y instantiates G at t

[25] Except for presentists (Hinchliff, 1996; Merricks, 1994). Interestingly, presentists avoid the difficulties considered here: the notion of the present, together with the metrical tense operators (e.g., "it was the case 20 minutes ago that"), let the presentist in effect speak of properties had at particular instants of time. Our target relationalist is not a presentist.

[26] A substantivalist who rejects temporal parts, that is.

x instantiates F n units of time after/before y and z stand in R:

> There exist times, t and t', such that t' is n units of time after/before t, x instantiates F at t', and$y$ and z stand in R at t

x bears R to y n units of time hence/earlier:

> There exist times, t and t', such that t' is n units of time after/before t, and x and y stand in R at t, t'

An example. In a situation in which object a is F for five minutes, then is G for another five minutes, the following statements would be true:

a is F one minute before a is F

a is F two minutes before a is F

a is F three minutes before a is F

a is F four minutes before a is F

a is F five minutes before a is F

a is G one minute before a is G

a is G two minutes before a is G

a is G three minutes before a is G

a is G four minutes before a is G

a is G five minutes before a is G

a is F one minute before a is G

a is F two minutes before a is G

.

.

a is F ten minutes before a is G

Thus qualitative change can be characterized on this view.

Facts of relative temporal location also emerge from the facts stateable in this language. Certain properties and relations are *existence-entailing*. As a substantivalist would say, if an object has a certain mass at a time, then the object must exist then. If two objects are ten feet apart from each other at a time, then each must exist at that time. If x as it is at t *causally affects* y as it is at t', then x must exist at t and y must exist at t'. (Some say that all properties and relations are existence-entailing, others that some properties, e.g., **being famous**, are not.) At any time a thing exists, it must surely have some existence-entailing property then, or stand in some existence-entailing relation then (whether cross-time or no). So the totality of facts about the instantiation of existence-entailing properties and relations fixes the relative temporal locations of all objects.

4. Spacetime relationalism and possibility[27]

The bundle theory collapsed possibilities involving indiscernible things. In the simplest case, a world containing a single F-thing was identified with a world containing two F-things. The relationalist theory has analogous consequences. Contrast a world containing just a single time, at which a thing, a, is F, with a second world that contains two disconnected times — two times neither of which is any temporal distance from the other — such that a is F at each. The relationalist will describe each as a case in which a is F zero units before a is F. Relationalism does indeed preclude a distinction between these worlds, but relationalists may well be happy to deny that the second world is a genuine possibility.[28]

A slightly more complicated example of indiscernible objects was that of worlds w_1 and w_2:

w_1: • F
↻
R

w_2: •← R →•
F F

But the analogous temporal case looks even less plausibly possible: w_1 contains a single time bearing temporal relation R to itself, and a is F at that time, whereas in w_2 two distinct times stand in R, and are such that a is F at each. But if R is **simultaneity** then the second world involves two distinct simultaneous times, whereas if R is, say, **being three minutes apart** then the first world

[27]This section shows that *some* temporally local entities should be postulated. One of us sees in this the starting point of an argument for temporal parts, on the grounds that the postulation of further enduring things would be ontologically redundant. See Sider (2001, chapter 4, section 8).

[28]Compare the disconnected spacetimes objection to modal realism discussed in Lewis (1986, pp. 71–73).

consists of a single time that is three minutes apart from itself. Either way, one of the alleged possible worlds seems impossible.

A somewhat more plausible example of this sort involves circular time. Compare a world with two-way infinite linear time containing a single thing, *a*, that is F at each moment, with a world with circular time, in which *a* is again F at each moment. In the two-way infinite world, *a* is F *n* units before *a* is F, for any *n*. But the same is true in the circular world, for one can simply travel around the circle again and again until *n* units has elapsed. (One might argue that '*a* is F *n* units before *a* is F' is true in the circular world only when *n* is less than the temporal circumference of the circle; perhaps so, but then the circular world cannot be distinguished from a world with a finite timeline of temporal length *n*.) These limitations concerning circular time constitute the most serious analog of the bundle theorist's limitations with indiscernible individuals. But it would take a bold metaphysician indeed to rest the case against relationalism solely on the belief in circular time as a distinctive possibility.

Other modal objections to the bundle theory carry over better. The relationalist's facts of property instantiation do not capture "linkages" between distinct property instantiations. Suppose that *a* is F for an instant, then five minutes later is G for an instant, and then five minutes after that is F again for an instant:

$$w_5\colon\ \begin{matrix} \bullet & \bullet & \bullet \\ \mathrm{F}a & \mathrm{G}a & \mathrm{F}a \end{matrix}$$

The relationalist will describe w_5 thus:

> *a* is F five minutes before *a* is G
>
> &
>
> *a* is G five minutes before *a* is F

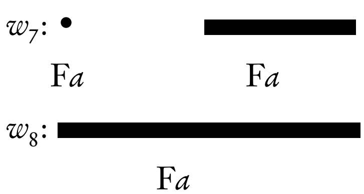
But, intuitively, this leaves out the fact that the case of *a*'s being G mentioned in the second sentence is the very same as the case of *a*'s being G mentioned in the first sentence.

One might worry that w_5 will be identified with another world in which *a* is F for an instant, then five minutes later is G for another instant; then, much later (say, 30 minutes later) is G for an instant, and then is F for an instant, five minutes after that:

w_6: Fa   Ga   ←30 mins→   Ga   Fa

In fact this is incorrect. The two sentences mentioned above are indeed true in each case; but further sentences distinguish the cases. For example, only in w_6 is it true that *a* is F 35 minutes after *a* is G. The pervasive character of the temporal relations makes the objector's work harder than with the bundle theory: in moving to $w_{6,}$ the second case of *a* being G must be added to the timeline somewhere; that then adds temporal facts that distinguish the worlds.[29] Relationalism is analogous in this way to the spatiotemporalist version of the bundle theory considered above.

The victory is short-lived: more complicated worlds are identified by the relationalist theory. Suppose that world w_7 contains a single object, *a*, which is F for an instant, then a minute later becomes F and remains F for a minute; world w_8 also contains only *a*, which is F for 2 minutes solid:



(Let *a* exist, and have property G at all other times, in each case.) These worlds do have the same relationalist description. For each *n* between 0 and 2, it will be true in each world that *a* is F *n* minutes before *a* is F. In w_7, for values of *n* between 0 and 1 these statements are made true by the one-minute-long stretch of F*a*; when *n* is between 1 and 2 the statements are made true by the single instant of F*a* and various points of the one-minute stretch.[30]

What is left out of the description is linkage. Only in w_8 is there, for example, an instant of F*a* followed 45 seconds later by an instant of F*a which in turn* is followed 45 seconds later by another instant of F*a*. That is, the very same case of F*a* that precedes the final case by 45 seconds occurs 45 seconds

[29]One could stipulate that i) the first and third times in world w_5 are temporally disconnected (despite each being temporally related to the second time), and that ii) the third and fourth times in w_6 are temporally disconnected from the first two. But then the cases are not at all pre-theoretically possible.

[30]Though we continue to assume sparse universals, adding negative universals would not help: in each case, for example, *a* is ∼F ten seconds after *a* is F (remember that *a* continues to exist in w_8 after the two-minute long stretch of being F.)

after the first case. Talk of "cases", though, is forbidden fruit: a "case of F*a*" would be either a temporally local event, or a temporal part, or an instant of time at which *a* is F. Can linkage be made acceptable?

Following our bundle theorist, the relationalist might complicate her ideology with new notions of instantiation, for example:

> (**) *a* is F 45 seconds before *a* is F, then *a* is F 45 seconds after that

(More carefully, following the notation of section 2: "*a* is F 45 seconds before *a* is F$|\alpha$; *a* is F 45 seconds after α"; we henceforth revert to informal notation.) (**) is to be true in w_8 but not w_7, and is therefore not reducible to the old "binary" statements of the form $\ulcorner\phi$ *n* units before $\psi\urcorner$, since those statements do not distinguish w_7 from w_8. While it may appear that the word 'that' in (**) is a referring expression, referring to the second "case" of *a*'s being F, the relationalist would claim that the sentence actually just makes a complicated statement about *a* and F, the general form of which is:

> (***) predication(x,F_1,n,y,F_2,m,z,F_3)

where x, y, and z are particulars, F_1, F_2 and F_3 are properties, and n and m are numbers representing temporal separation in some chosen unit.

The relationalist cannot stop with (***). Consider two worlds, w_9 and w_{10} with discrete time, each containing a single thing, *a*, that has always been red in the past, and then at some point in time begins to alternate between red and blue. In w_9 the alternation looks like this: BRBBRRBBBRRRBBBBRRRR…In w_{10}, the first two alternations are swapped: BBRRBRBBBRRRBBBBRRRR…These worlds *can* be distinguished using a "four-place" locution — '*a* is blue one instant before*a* is red, then *a* is blue one instant after that, then *a* is blue two instants after that' is true only in w_{10} — but not by the three-place locution (***). Neither will the relationalist want to stop with four-place locutions. New irreducible locutions corresponding to all the possible temporal patterns of instantiation of properties will be introduced, for example:

> *a* is F 1 minute before *b* is G, then *c* is H 3 minutes after that, then *d* is I 2 minutes after that.
>
> *a* is F 1 minute before *b* is G, then *c* is H 3 minutes after that, then *d* is I 2 minutes after that, then *e* is J 5 minutes after that.
>
> etc.

None of these forms will be reducible to conjunctions of simpler ones, for the same reason that (**) needed to be irreducible to binary statements: there is no way to link the property instances attributed by multiple simpler statements without appealing to temporally local entities.

As before, this results in holism: the world cannot be described as the sum total of simple facts, since the complex does not supervene on the simple. As before, the theory's ideology contains infinitely many distinct primitive notions.[31] Each consequence offends against the metaphysical aesthetic.

(A related ugliness may afflict even the unmodified relationalist theory. As mentioned, substantivalists about time who reject temporal parts say that objects have properties *at* times. David Lewis objects that this turns properties into relations. Surely a certain metal bar is *just plain straight*, whereas the substantivalist endurantist must say that it is straight *at*, or with respect to, a time.[32] The relationalist theory also seems to turn properties into relations — in fact, relations to other *objects*. The bar's straightness is expressed in sentences of the form: the bar is straight n units of time after ϕ, in which ϕ may mention other things. In *some* cases ϕ will mention only the bar, for example statements of the form 'the bar is straight n units after the bar is F' and 'the bar is straight 0 units after the bar is straight'. But all such statements equally well express the bar's straightness.)

Unless the enhanced ideology includes infinitary notions, the relationalist theory still conflates intuitively distinct possibilities. Suppose that in one world a certain light comes into existence at some time, and flashes red and blue every minute forever after, whereas in a second world it has existed forever and will continue to exist forever, flashing red and blue as before. Statements such as:

> the light is red one minute before it is blue,
>
> the light is red one minute before it is blue, then is red one minute after that
>
> the light is red one minute before it is blue, then is red one minute after that, then blue one minute after that

[31] Might a single sentence operator ⌜ϕ n units before ψ⌝, capable of iteration (as in ⌜ϕ n units before ψ m units before χ⌝) replace the infinity of primitive locutions? This operator handles only ascriptions of properties and single-time relations; cross-time relations are more complex. But tricks like those mentioned in note 16 might well suffice.

[32] Lewis (1986, pp. 202–204). See also Sider (2001, chapter 4, section 6).

> the light is red one minute before it is blue, then is red one minute after that, then blue one minute after that, then red one minute after that
>
> etc.

will not distinguish the worlds; the following infinitary sentence is needed:

> …the light is red one minute after that, then blue one minute after that, then red one minute after that, then blue one minute after that …

As with the bundle theorist's infinitary locution, this sentence is irreducible to finite sentences; the predicational form:[33]

> …then one minute after that, ϕ_{-1}, then one minute after that, ϕ_0, then one minute after that, ϕ_1, then one minute after that …

cannot be reduced to finite forms.

This epicycle recapitulates our theme. Bundle theorist and temporal relationalist alike purchase the modal differences we want with unfamiliar irreducible locutions. The cost is an unsightly ideology, and a holism unworthy of the name metaphysics.[34]

References

Armstrong, David M. (1978). *Nominalism and Realism*, volume 1 of *Universals and Scientific Realism*. Cambridge: Cambridge University Press.

Black, Max (1952). "The Identity of Indiscernibles." *Mind* 61: 153–64.

[33] This form cannot distinguish a single two-way infinite time line from a pair of two-way infinite time lines laid end to end, but if these really are distinct possibilities then perhaps an infinite locution with an analogous structure will distinguish them. And handling these discrete cases is not the end of the story; the relationalist must introduce means to define such notions as temporal density, continuity, and the like.

[34] It is perhaps unduly harsh to withhold the label metaphysics from Parmenides, Hegel, Bradley, and some distinguished contemporaries. When arguments are lacking, rhetoric is called for. The lack of arguments is no fault of Tamar Szabó Gendler, Gilbert Harman, Brian Weatherson, and Dean Zimmerman, who we thank for their helpful comments.

Cover, J. A. and John (O'Leary-) Hawthorne (1998). "A World of Universals." *Philosophical Studies* 91: 205–19.

Friedman, Michael (1983). *Foundations of Space-Time Theories*. Princeton: Princeton University Press.

Haslanger, Sally and Roxanne Marie Kurtz (eds.) (2006). *Persistence: Contemporary Readings*. Cambridge, MA: MIT Press.

Hawthorne, John (O'Leary-) (1995). "The Bundle Theory of Substance and the Identity of Indiscernibles." *Analysis* 55: 191–96.

Hinchliff, Mark (1996). "The Puzzle of Change." In James Tomberlin (ed.), *Philosophical Perspectives*, volume 10, 119–36. Cambridge, MA: Blackwell. Reprinted in Haslanger and Kurtz 2006: 287–306.

Lewis, David (1986). *On the Plurality of Worlds*. Oxford: Basil Blackwell.

Merricks, Trenton (1994). "Endurance and Indiscernibility." *Journal of Philosophy* 91: 165–84.

Mundy, Brent (1983). "Relational Theories of Euclidean Space and Minkowski Space-Time." *Philosophy of Science* 50: 205–26.

Quine, W. V. O. (1960). "Variables Explained Away." *Proceedings of the American Philosophy Society* 104: 343–47. Reprinted in Quine 1966: 227–35.

— (1966). *Selected Logic Papers*. New York: Random House.

Russell, Bertrand (1914). *Our Knowledge of the External World*. Chicago, IL: Open Court.

— (1940). *An Inquiry into Meaning and Truth*. London: Allen and Unwin.

— (1948). *Human Knowledge: Its Scope and Limits*. London: Routledge.

Sider, Theodore (1996). "All the World's a Stage." *Australasian Journal of Philosophy* 74: 433–53. Reprinted in Haslanger and Kurtz 2006: 91–117.

— (2001). *Four-Dimensionalism*. Oxford: Clarendon.

Van Cleve, James (1985). "Three Versions of the Bundle Theory." *Philosophical Studies* 47: 95–107.