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REARRANGEMENT OF PARTICLES:  
REPLY TO LOWE

By DAVID LEWIS

I BACKGROUND

ORDINARY things, for instance we ourselves, undeniably persist through time. As we persist, we change. And not just in extrinsic ways, as when a child was born elsewhere and I became an uncle. We also change in our own intrinsic character, in the way we ourselves are, apart from our relationships to anything else. When I sit I'm bent, when I stand I'm straight. When I change my shape, that isn't a matter of my changing relationship to other things, or my relationship to other changing things. *I* do the changing, all by myself. Or so it seems. What happens must be possible. But how? Nothing can have the two incompatible shapes, bent and straight. How does having them at different times help? In *On the Plurality of Worlds* (Blackwell, 1986; henceforth *PoW*), p. 204, I listed three solutions, and said that only the third was tenable.

The first solution is that the 'properties' are really relations to times. That lets us say that things persist by *enduring*: the one thing is present at different times; and not mere temporal parts of it, different parts at different times, but *all* of it, wholly present at each of the times. The whole of me stands in the bent-at relation to some times and the straight-at relation to others. I complained that shapes are properties, not relations. No doubt a friend of the first solution will draw a distinction that he will *call* the distinction between matters of one's own intrinsic character and matters of one's relationships: having a shape will go on one side, being an uncle on the other. But call it what he will, his account reveals that really he treats shape, no less than unclehood, as a matter of relations. In this account, nothing just has a shape *simpliciter*. The temporary 'intrinsic properties' of things, so understood, do not deserve the name. This solution amounts to a denial that things really do have temporary intrinsics, and therefore is untenable.<sup>1</sup>

<sup>1</sup> The first solution has an 'adverbial' variant, defended in Sally Haslanger, *Change, Persistence, and Possibility* (Ph.D. dissertation, University of California, Berkeley, 1985); and, at least as a possibility, in Mark Johnston, 'Is There a Problem About Persistence?', *Aristotelian Society Supplementary Volume* 61 (1987), pp.

The second solution says that there is only one genuine time, the present. Intrinsic properties are genuine properties, and a thing can have them *simpliciter*, without regard to any relationships to anything else. However, the only intrinsic properties it has *simpliciter* are the properties it has *now*. What passes for persistence and change, on this solution, does not really involve other times. Rather, there are 'abstract' ersatz times, to go with the one 'concrete' genuine time. These represent, or misrepresent, the present. If I am bent now, and straight later, there is an abstract misrepresentation of the present according to which I am straight. 'Persistence' and 'change', so understood, do not deserve their names. This solution amounts to a denial of persistence and change, and therefore is untenable.<sup>2</sup>

The third solution, the tenable one, is that incompatible temporary intrinsic properties do not all belong to the same thing. A persisting thing *perdures*. It consists of temporal parts, or *stages*, different ones at different times, which differ in their intrinsic properties. When I sit and then stand, bent stages are followed by straight stages. Each stage has its shape *simpliciter*. Shape is truly intrinsic.

To be sure, my shapes belong in the first instance to my stages, and in a derivative, relational way to the whole of me. Persisting thing  $x$  is bent at time  $t$  iff some stage of  $x$  is at  $t$  and is bent. What distinguishes the first solution from the third is not that the third does away with shape-at-a-time relations. Rather, it is that the first has wrongly done away with shapes as intrinsic properties that can be had *simpliciter*.

Imagine trying to draw a picture of two different times,  $t_1$  when I sit and  $t_2$  when I stand. You draw two circles, overlapping because I exist at both times so you want to draw me in the inter-

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107–35. The adverbial variant avoids my complaint that shapes are not relations. It puts the relationality not in the shapes themselves but in the having of them: there is a three-place relation of instantiation, this relation holds between me and bentness and some times, and it holds between me and straightness and other times. I ask: what does standing in some relation to straightness have to do with just plain being straight? And the variant still claims that to be shaped is to stand in relations to other things, *inter alia* to times. I say it still amounts to a denial that things have temporary intrinsics.

<sup>2</sup> The second solution also has an 'adverbial' variant, defended in discussion by Mark Hinchliff. It omits or plays down the ersatz times. Instead, temporal modifiers introduce relations of things to properties. If I am now bent, bent is just the way I am; whereas if I will be straight later, I stand in some relation to straightness which does not involve any having *simpliciter* of straightness by anything. Change between two times, one of them the present, is the modified-having of a property incompatible with a property the thing simply has. Change between two non-present times is modified-having of two incompatible properties. But the modified-having itself goes on in the present. I ask again: what does standing in some relation to straightness have to do with just plain being straight? And the variant still denies that 'persistence' and 'change' involve any genuine times/except the present. I say it still amounts to a denial of persistence and change.

section. But then you have to draw me bent and also straight, which you can't do; and if *per impossibile* you could, you still wouldn't have done anything to connect the bentness to  $t_1$  and the straightness to  $t_2$  instead of *vice versa*. What to do? The first solution says to draw the circles overlapping, draw me in the intersection as a mere dot or shapeless blob, draw a line labelled 'bent-at' from me to the  $t_1$  circle and a line labelled 'straight-at' from me to the  $t_2$  circle. A queer way to draw a shape! The second solution says to draw only the  $t_1$  circle, and in it draw me bent; and then draw not another circle but an abstract misrepresenter saying that I'm straight. The third solution says to draw two *nonoverlapping* circles, in the  $t_1$  circle draw me bent, in the  $t_2$  circle draw me straight, and then draw a connexion to indicate that the bent me plus the straight me add up to a single person.

## II LOWE'S FOURTH SOLUTION

In his 'Lewis on Perdurance Versus Endurance' (ANALYSIS 47.3, June 1987, pp. 152-54), E. J. Lowe agrees that we need a solution, and joins me in rejecting the first and second solutions. But he rejects the third solution as well. He finds it 'scarcely intelligible' to say that things like people or puddles, as opposed to events or processes, have temporal parts. I disagree; but won't repeat here what I have said elsewhere about the intelligibility of temporal parts.<sup>3</sup> Lowe does find perdurance intelligible enough to be denied, and deny it he does.<sup>4</sup> After rejecting all three solutions, Lowe is urgently in need of a fourth.

I too would welcome a fourth solution, but for quite a different reason. If the third solution alone is tenable, then our common-sense belief in persisting things commits us implicitly to perdurance — and this despite the fact that some of us firmly reject the notion of temporal parts (except of events or processes) and many more have never heard of it! It would be better not to impute such surprising commitments to common sense, but only the plain commitment that things do somehow persist, never mind exactly how they do it.<sup>5</sup> If we had two tenable solutions — some sort of endurance theory, as well as the perdurance theory — to

<sup>3</sup> In my *Philosophical Papers*, Volume I (Oxford University Press, 1983), pp. 76-7.

<sup>4</sup> It is odd that when Lowe denies perdurance, he does not embrace endurance. I should have thought it automatic that if a persisting thing is present at a time, and not just partly present, then it must be wholly present. Lowe doesn't say why he finds 'wholly present at a time' problematic. Maybe he thinks the phrase carries a presupposition that the thing has, or at least is of a kind to have, temporal parts. I intend no such presupposition. If you think it is there, let it hereby be suspended. Then we may carry on saying that a thing 'endures' if it persists without having temporal parts; *a fortiori* if it persists and is of such a kind that it cannot intelligibly have temporal parts.

<sup>5</sup> Here I follow the lead of Johnston, *op. cit.*

suspend judgement between, then such restraint would be feasible as well as sensible. Then we could leave the question of endurance versus perdurance forever unsettled, or perhaps settle it by finding out which coheres better with total science. At any rate we could *not* settle it 'philosophically', by drawing out unsuspected consequences of common-sense intuitions. But if we're stuck with the third solution alone, restraint is beyond our reach.

Here is Lowe's fourth solution. Science teaches that things consist of particles. A change of shape for the thing, for instance for me when I sit and then stand, is a rearrangement of its particles. (Likewise for other intrinsic changes, for instance in my temperature or neural activity.) When the particles are rearranged, they undergo a change in their relations to one another; but no change in their intrinsic properties. In fact, it seems likely that fundamental particles *never* change their intrinsic properties. An electron or a quark has a certain charge, rest mass, and so on; all constant, from the creation of the particle to its destruction, no matter how the particle may move around and change its relations to other particles. There is no problem of intrinsic change for particles, if they have no temporary intrinsics. Particles, at least, may safely be supposed to endure; and larger things consist of these enduring particles, undergoing rearrangement but no intrinsic change.<sup>6</sup>

### III FIRST OBJECTION, AND A REPLY

It may be true that particles have no temporary intrinsics. But it is far from certain, and far from necessary. Lowe's solution is at risk from scientific surprises. He might read in tomorrow's paper that the charges of electrons and quarks are not constant after all. They undergo fluctuations too small to detect with yesterday's instruments. If so, must Lowe conclude, after all, that there is no way he can persist? So it seems; because his solution to the problem of his own intrinsic change requires him to consist of particles not subject to intrinsic change.

Likewise, Lowe's solution makes no sense of counterfactual suppositions about persisting people in a world where particles

<sup>6</sup> I wrote concerning 'fundamental particles *or momentary slices thereof*' (italics added) that 'maybe these things have no accidental intrinsic properties' and hence 'we would not face a problem of accidental intrinsics' for them (*PoW*, p. 205). Lowe cites this as conceding the point he needs; which is peculiar, because accidental intrinsics are not the same thing as temporary intrinsics. For instance a particle might well have the shape of its entire spatiotemporal trajectory as an *accidental*, but certainly not *temporary*, intrinsic property — wherefore my italicized phrase.

No harm done. Though the two hypotheses are independent, it is at least as probable that particles lack temporary intrinsics as it is that they, or their slices, lack accidental intrinsics.

fluctuate in charge. Such a world is possible — at any rate, counterfactual suppositions about it are intelligible — even if it contravenes the actual laws of nature. It doesn't matter whether the otherworldly fluctuating particles are genuine electrons and quarks, so long as some things made of these particles are genuine people — which they well might be.

I offer Lowe this reply. In the case of ordinary large things, such as ourselves, we are entitled to firm intuitions about what should count as just the way the thing itself is, and not at all a matter of relationships. For instance, we should be firm in resisting the idea that our shapes are really relations to times. But it is otherwise for the 'properties' of particles; even for the most familiar ones, charge and rest mass, let alone the new-found 'spins' and 'flavours' and 'colours'. It is up for grabs whether these are as intrinsic as we offhand think. Lacking close acquaintance with the submicroscopic realm, we should be open-minded. If charge turns out to fluctuate, and if our only solution to the problem of persistence requires that particles never undergo intrinsic change, that might be reason enough to conclude that charge — unlike shape! — is really a relation to times. Or if we suppose counterfactually that charge fluctuates, we might insist on making it part of the supposition that charge is not, after all, an intrinsic property.

#### IV SECOND OBJECTION, AND A REPLY

Even if the problem of temporary intrinsic *properties* goes away, for particles at least, there is still a problem of temporary intrinsic *relations*.<sup>7</sup> Exactly as some properties are just a matter of how the thing itself is, without regard to any relationship to any second thing, so some relations are just a matter of how two things are *vis-à-vis* one another, without regard to any relationship to any third thing. The relation is intrinsic to the pair of *relata*. The ever-changing distances of particles from one another seem to be temporary intrinsic relations. Rearrangement of particles poses the same old problem of temporary intrinsics, except that now it is a problem about intrinsic relations rather than intrinsic properties. How can the same two things stand in different, incompatible intrinsic relations? How can the same two particles have two different distances? How does it help that they have them at different times?

We have three solutions, as before. First solution: particles have their temporary distances by standing in different relationships to

<sup>7</sup> It corresponds to the problem of accidental external relations noted in *PoW*, pp. 205–6, just after the 'concession' Lowe cited. 'External' relations, in one sense of the term, are those intrinsic relations that do not merely supervene on the intrinsic characters of their *relata*.

different times. They endure, so whatever relations they enter into must be relations of the entire enduring particle. But there is no such thing as being a certain distance apart *simpliciter*. Instead there are three-place distance-at-a-time relations. This solution is untenable because it amounts to a denial that distances are intrinsic relations. Second solution: there is only one genuine time, the present, and the only distance there is between two particles is their distance *now*. What passes for persistence and change is the abstract misrepresentation of this one time, according to which the two particles exist and have some different distance. This solution is untenable because it amounts to a denial of persistence and change. Third solution: the particles perdure, and it is in the first instance their temporal parts that are various distances apart. Lowe will reject this as 'scarcely intelligible'. Properties or relations, it's all the same problem. What has Lowe gained?

Try again drawing the circles for  $t_1$  and  $t_2$ , overlapping now because a certain two particles exist at both times and so you want to draw them in the intersection. They've undergone rearrangement, as particles often do. You have to draw them at two different distances apart, which you can't do; and if *per impossibile* you could, you still wouldn't have done anything to connect one distance to  $t_1$  and the other to  $t_2$  instead of *vice versa*. What to do?

I offer Lowe this reply. Suppose he is prepared to accept a substantialist theory of spacetime, and one that distinguishes occupants of spacetime from the regions of spacetime they occupy. It might be nicer to stay neutral, but if Lowe has the problem about persistence that he thinks he has, a solution would be worth the commitment. Then for each particle, there is a spacetime region that is its trajectory. Lowe might grant that a spacetime region has temporal parts: it is like an event or process, unlike a person or puddle or particle. Suppose (for convenience only) that the particles are point-sized; then the smallest temporal parts of their trajectories are spacetime points. An enduring particle is wholly present at each point on its trajectory. Distances are intrinsic relations, sure enough; but of points, not particles. When two points are a certain distance apart, that's just a matter of how the two points are *vis-à-vis* one another, regardless of any relationship to any third thing. Enduring particles have their distances in a derivative and relational way: particles  $x$  and  $y$  are one metre apart at  $t$  iff points  $p$  and  $q$  are one metre apart,  $p$  and  $q$  are at  $t$ ,  $p$  is one of the points where  $x$  is, and  $q$  is one of the points where  $y$  is. So in the first instance it is the trajectories that undergo rearrangement. They change their distances from one another in the unproblematic fashion of perdurers. Their different temporal parts, at different times, are at different distances. The particles undergo rearrangement vicariously: their trajectories do it for them. All the particle has to do is to occupy each point of its trajectory. That requires no change in intrinsic relations. The particle need only

bear the same intrinsic relation of occupancy to each of many points.

Draw the circles overlapping; put the particles themselves in the intersection; but put all the spacetime points which the particles occupy outside the intersection, some in the  $t_1$  circle and some in the  $t_2$  circle. Draw lines of occupancy from the particles to their points.

This might be acceptable, as a last resort, if we had eliminated the alternatives. It is peculiar to say that the particle is only indirectly involved in its own relationships of distance; but at least these turn out to be proper intrinsic relationships of *something*, and what's more, something intimately associated with the particle. What makes this picture of endurance barely acceptable is that it has so much *perdurant* mixed in.

## V FINAL OBJECTION

Waive the first two objections. Give Lowe enduring particles, and their rearrangement. I want to ask: what has this to do with *me*? My particles endure, but what do I do?

A strange worry. Surely I am nothing over and above my particles: I am them, they are me. The 'are' of composition is just the plural of the 'is' of identity. So if it's settled what they do, there can't be any further question what I do. You might as well say: I know all about the life of Cicero, now what about Tully?

I can agree to this, or near enough; but Lowe can't. Strictly speaking, of course, neither of us can say that I am my particles. If I were, I would exist whenever they do; but I don't. My beginning was a rearrangement of preexisting particles; my end will be a rearrangement of particles that will exist afterward. Further, I eat and excrete; so I cannot be identical both to the particles I was composed of yesterday and to those I am composed of today. But for me, as a perdurance theorist, the correction is close at hand. I consist of temporal segments of particles. So what's true to say, by way of identifying myself with my particles, is that I am my particle-segments. But for Lowe, who rejects particle-segments, this correction will be 'scarcely intelligible'. I think he has no other way to make sense of saying that I just *am* my particles. Composition as identity is not for him.

He will need, instead, to understand composition as a one-many relation of things that are in no sense identical. (It will be a temporary intrinsic relation, and so will give him a new problem of temporary intrinsics.) The relation of me to my particles is an interesting and intimate one, no doubt. But if it is not identity, then to say that my particles endure is simply not to address the question whether *I* endure; and how, if I do endure, I manage to undergo intrinsic change. What my particles do is, strictly speak-

ing, irrelevant. Lowe has not offered any fourth solution, satisfactory or otherwise, to the problem of my intrinsic change. Rather, he has changed the subject.<sup>8</sup>

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<sup>8</sup> I thank Donald Baxter, Sally Haslanger, Mark Hinchliff, and especially Mark Johnston for helpful discussions.

### THE PROBLEMS OF INTRINSIC CHANGE: REJOINDER TO LEWIS

*By E. J. LOWE*

IN 'Rearrangement of Particles: Reply to Lowe' (above, pp. 65–72), David Lewis presents a formidable response to my article 'Lewis on Perdurantism Versus Endurance' (*ANALYSIS* 47.3, June 1987, pp. 152–4). He concludes by saying that I have 'not offered any fourth solution, satisfactory or otherwise, to the problem of...intrinsic change. Rather, [Lowe] has changed the subject.' However, since writing my earlier article it has become apparent to me that there is more than one subject, because there are in fact two distinct problems of intrinsic change — a *semantic* problem and a *metaphysical* problem. Further, I believe that Lewis's favoured solution (in terms of temporal parts) fails not least because it attempts to cope with both problems at once, for this helps to make it a bad solution to each. It is a bad solution to the semantic problem because (and Lewis himself expressly recognizes this difficulty) it imputes surprising ontological commitments to the very meaning of our common-sense talk of persistence through change. But equally it is a bad solution to the metaphysical problem, in part precisely because it is one substantially driven by extraneous semantic objectives. These extraneous objectives also blind Lewis to the superior merits of the sort of scientifically motivated solution to the metaphysical problem that I defended in my earlier article.

The remainder of this paper is divided into two parts, the first dealing with the semantic problem of intrinsic change and the second with the metaphysical problem.

#### I

The *semantic* problem of intrinsic change is the problem of specifying the logical form of sentences ascribing temporary