



## Identity and spatio-temporal continuity

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## DISCUSSION

B. N. LANGTRY

### IDENTITY AND SPATIO-TEMPORAL CONTINUITY<sup>1</sup>

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It is widely believed that continuity of existence through time is a logically necessary condition of the identity of physical objects. G. C. Nerlich has argued as follows.<sup>2</sup> Suppose that an object exists at place  $p_1$  from  $t_1 - t_2$ , and then passes out of existence, and that at  $t_3$  a qualitatively similar object comes into existence at place  $p_1$ . Such a case of spatio-temporal discontinuity is one in which the counterfactual conditional, 'If the object at  $t_1 - t_2$  had continued to exist until  $t_3$ , it could in principle have been set beside the object which began to exist at  $t_3$ ,' is true. But a state of affairs in which the objects exist beside each other at the same time is a paradigm example of numerically different objects. Thus we must deny identity in our case of discontinuity.

Someone might object that in asserting the counterfactual it is being *assumed* that the object which began to exist at  $t_3$  did not exist at any time prior to  $t_3$ : for if the object which existed from  $t_3$  onwards had already existed from  $t_1 - t_2$ , of course it could not, had it existed also in the  $t_2 - t_3$  interval, have been set beside *itself* at  $t_3$ . On the other hand, it is hard to deny that there could have existed two spatially separated items of one sort or another at  $t_3$ .

Now Victoria and New South Wales are indeed numerically different physical objects. Yet one man might stand in Victoria while another man stood in New South Wales, and it be correct to say that they were both standing on the same physical object. One who affirmed this would have an enriched ontology which embraced an object, e.g. the Australian Continent of which Victoria and New South Wales were spatial parts. Thus there is a certain ambiguity in the question of whether the object that the first man was standing on could drift a thousand miles from the object the second man was standing on; for while Victoria could drift a thousand miles from New South Wales, the Australian Continent could not drift a thousand miles from itself. These considerations suggest that we recast the original problem so as to avoid wearisome dispute as to who, if anyone, is begging the question.

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<sup>1</sup> This paper has benefited from discussion with Professors C. B. Martin and G. C. Nerlich.

<sup>2</sup> G. C. Nerlich, 'Sameness, Difference and Continuity', *Analysis*, 1958, pp. 144-149. See also his '“Continuity” Continued', *Analysis* 21 (1960), pp. 22-24.

Let 'A' name the four-dimensional item which exists at  $p_1, t_1 - t_2$  and only at this location, and let 'B' name the four-dimensional item which exists at  $p_1, t_3 - t_4$  and only at this location. Thus A is not identical with B. Suppose it has been decided to admit four-dimensional (physical) objects into our ontology. The question is whether there is some such object of which A and B are spatio-temporal parts, and which has no spatio-temporal part occupying the temporal interval  $t_2 - t_3$ .

Nerlich points out in effect that if A had extended temporarily to  $t_4$ , its shape might have been such that at its point of temporal overlap with B it was only a short spatial distance from B. Yes; but it has already been agreed that A and B are numerically different. The claim seems to be that in the situation counterfactually supposed, A and B *logically cannot* be spatio-temporal parts of the one four-dimensional object. But why not? Suppose that at  $t_3$  a new island is formed near Bali by volcanic activity. The Bali time-slice  $t_1 - t_4$  and the new island time-slice  $t_3 - t_4$  are both spatio-temporal parts of the four-dimensional Indonesian archipelago. Similarly when new helium atoms are formed in the interior of the sun. Hence the argument of Nerlich outlined at the beginning of this paper is unsound.

One must indeed allow the existence of spatially scattered physical objects; for the alternative is to deny the applicability of the term 'physical object' to all the macro-entities our science knows, and most of the micro-entities as well.<sup>3</sup> Nerlich must explain what asymmetry is responsible for the fact that continuity of existence through time is a logically necessary condition of the identity of physical objects, whereas continuity of existence through space is not. (It might be said that physical objects such as tables or people have spatial but not temporal parts. This point is discussed below.)

The following case might be raised.<sup>4</sup> We have item A at  $p_1, t_1 - t_2$  as before, but two items B and C, exactly similar to each other, at  $p_0, t_3 - t_4$  and  $p_2, t_3 - t_4$  respectively. Let us suppose that, as in most situations, it is implausible to say that B and C are both parts of the one spatially (and temporally) scattered object, e.g. B and C are wristwatch time-slices or person time-slices. Then it will not be the case that B and C are both parts of some one object of which A is also a part. Hence we must say that *neither* B nor C is a part of some object of which A is also a part; for *ex hypothesi* there is nothing about either to make *it* rather than the other a part of some object of which A is also a part.

This argument is invalid. It does not follow from the fact that there is no object of which B and C are both parts that either there is no object of

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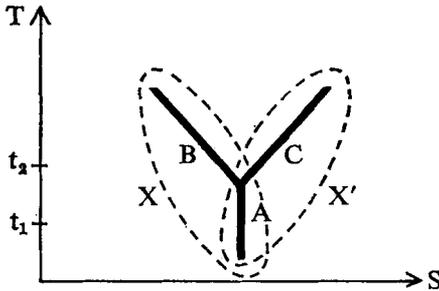
<sup>3</sup> One should reject ordinary language arguments to the effect that, since words like 'continuous' are taught by means of examples such as the tops of tables, these must really be spatially continuous objects. They are not.

<sup>4</sup> Cf. Nerlich's discussion of B. A. O. Williams's case, 'Sameness, Difference and Continuity', *Analysis* 1958, p. 144. It is important to note that while Nerlich's names 'A', 'B', 'C' refer to persons, my 'A', 'B', 'C' refer to spatio-temporal slices of four-dimensional physical objects.

which A and B are both parts or there is no object of which A and C are both parts. That is, reading 'ASx' as 'A is a spatio-temporal part of object x'.

$$\sim [(\exists x)(ASx . BSx). (\exists x)(ASx . CSx) \rightarrow (\exists x)(BSx . CSx)]$$

The situation may be illustrated by a normal amoeba case. Here  $A \neq B \neq C$ . There are two four-dimensional objects, X and X', which have a common spatio-temporal part, A. That is, a person who stretched out his arm towards A and asked 'Which object am I pointing to?' would be answered correctly by 'X' and 'X'.



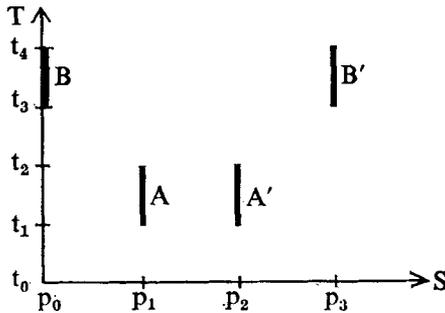
One might feel unfamiliar with the idea of two four-dimensional objects having a common spatio-temporal part. Yet there is nothing unusual about the idea of two three-dimensional physical objects temporarily occupying the same place at the same time. For example, at this moment Nixon's chair supports two numerically distinct physical objects, namely, Nixon and the heap of atoms G which at present constitute Nixon—for they have different life-spans. The object time-slices *Nixon*  $t_1 - t_2$  and *heap of atoms G*  $t_1 - t_2$  are numerically the same. (The most satisfactory account of the relation 'constitutes' between three-dimensional physical objects is in terms of identity of spatio-temporal slices.)

It might be argued that in the amoeba case X and X' cannot be correctly described as 'physical objects', but are four-dimensional objects having as spatio-temporal parts A and B, and A and C respectively. The concept of a physical object, such as a table or a person, is the concept of something which continues through time, as distinguished from the concept of something which has temporal extension: if a physical object (*i.e.* with all its *spatial* parts) exists at a particular time, then the *whole* object exists at that time. This is what gives rise to the traditional problem of amoebas and the transitivity of identity. Let the continuant physical object which exists at  $t_1$  be M, and let the continuant physical objects which exist at  $t_2$  be N and O; since  $N \neq O$ , either  $M \neq N$  or  $M \neq O$  or identity is not transitive.

However, these considerations do not render irrelevant my reply to Nerlich's original argument for continuity as necessary for the identity of physical objects. For, as he himself now emphasizes, current physics commits us to admitting four-dimensional objects into our ontology, and to regarding talk about continuant physical objects as a mere manner of

speaking.<sup>5</sup> The fact that it is proper to talk about two four-dimensional objects having a common spatio-temporal part raises problems for our informal talk about three-dimensional physical objects; specifically, we sound as if we are giving up the transitivity of identity. This must simply be accepted as one of the shocks that science gives to ordinary language. What we want to say in our canonically formulated theory does not involve our abandoning the principle of the transitivity of identity.

A further example might be presented.<sup>6</sup> We have A at  $p_1, t_1 - t_2$  and B at  $p_0, t_3 - t_4$ , but also A', qualitatively similar to A, at  $p_2, t_1 - t_2$ , and B', qualitatively similar to B, at  $p_3, t_3 - t_4$ . Let us assume that there is no four-dimensional object of which A and A' are both parts and that there is no four-dimensional object of which B and B' are both parts. Then here are some of the many possible alternatives,



- (i) A and B are parts of a spatio-temporally scattered object X, while A' and B' are parts of a scattered object Y,
- (ii) A and B' are parts of a scattered object Z, while A' and B are parts of a scattered object W,
- (iii) A and B are parts of a scattered object X, and A and B' are parts of a scattered object Z, while A' is a part of no object of which either B or B' are also parts,

and so on. The difficulty is not just that we do not *know* which of these alternative hypotheses is correct, but that there is *nothing* in the world to make one of them correct over and against the others. So in the case in which we have A and B only, what is the truthmaker for the claim that A and B are parts of the one object X?

This argument does not demonstrate that a spatio-temporal gap between two object-slices precludes their being parts of numerically the same four-dimensional object. It does support the conclusion that mere relations of qualitative similarity between object-slices is not logically sufficient for their

<sup>5</sup> This is the claim of A. Einstein, 'Autobiographical Notes' in P. A. Schilpp (ed.), *Albert Einstein: Philosopher-Scientist* (2nd edition 1951), pp. 57, 59; reprinted in J. J. C. Smart (ed.), *Problems of Space and Time* (1964), pp. 281-282. See also H. Minkowski, 'Space and Time', reprinted in Smart, *op. cit.*, pp. 297-312.

<sup>6</sup> Cf. Nerlich, *op. cit.*, pp. 148-149.

being parts of the one object.<sup>7</sup> This directs our attention to the question of what criteria are used for grouping various spatial slices into the one physical object. For the present discussion it suffices to note, among others, the following:<sup>8</sup>

(1) *Common Cause.* Mountains  $M_1$  and  $M_2$  are counted as parts of the same discontinuous range while nearby  $M_3$  is not, because  $M_1$  and  $M_2$  were thrown up by the same geological disturbance, whereas  $M_3$  arose in some other way.

(2) *Mutual causal interaction.* Sails are counted parts of ships, and animal parts of different herds, swarms, etc., often in virtue of the way in which they interact with certain other things.

Assuming that the notion of causation across a spatio-temporal gap is logically in order, these criteria may be applied to cases of temporal discontinuity. Let us leave aside purely epistemic problems. We now have some hope of giving a truthmaker for the correct hypothesis in such a case as that of A, A', B, B' discussed above: namely, the holding of such-and-such causal relations between the items involved.<sup>9</sup> Of course an item A at  $p_1, t_1 - t_2$  might have had such-and-such causal effects on each of B at  $p_0, t_3 - t_4$  and C at  $p_2, t_3 - t_4$ , but this can be handled as an amoeba case, along the lines suggested above.

Nerlich,<sup>10</sup> discussing tune-tokens as alleged examples of spatio-temporally discontinuous physical objects, asserts that of particulars it always makes sense to ask, 'Has anyone suddenly substituted an exactly similar thing for the one we were observing a minute ago?' Now a distinction between 'same physical object' and 'exactly similar physical object' has been drawn (partly) in terms of the causal relationships in which the object-slices stand. But suppose it is asserted that an object O (e.g. Merlin, or God) produced a physical object X which existed at place p at times  $t_1 - t_2, t_3 - t_4$  only. Nerlich asked: What is the truthmaker for this claim, over and against the counter-claim that O produced an object X at place p at time  $t_1 - t_2$ , and a similar object Y at place p at time  $t_3 - t_4$ ? *The assertion of identity collapses into the assertion of similarity.*

One interpretation of this is as follows: 'It is suggested that being FGH is logically sufficient for being I. But then the truthmaker for the claim that here is a case of GHI would be just the same as the truthmaker for the claim that here is a case of FGH. So the assertion that I obtains would collapse into the assertion that F obtains, and the distinction between being I and being F becomes vacuous.' This argument is patently invalid.

<sup>7</sup> Therefore the above considerations constitute an objection to Quine's claim that 'red' and 'water' in subject position may be conceived as singular terms naming the scattered totalities of red substance and aqueous stuff respectively (*Word and Object*, p. 98).

<sup>8</sup> Of course it is not claimed that either of these is either necessary or sufficient for identity.

<sup>9</sup> In saying this I clearly commit myself to rejecting any Humean theory of causality. The question of what account of causality can be given by a metaphysics committed to an ontology of four-dimensional objects cannot be discussed here.

<sup>10</sup> In an unpublished 1958 thesis, 'Identity and Continuity'. In fact Nerlich is probably right in regarding tune-tokens as processes or events, rather than physical objects.

Consider the queries, (i) What is the truthmaker for the claim that Bali and Java are parts of the one archipelago, over and against the counter-claim that they are parts of different, though similar, archipelagos produced at the same time by the same geological process? (ii) What is the truthmaker for the claim that H is the same watch reassembled according to the old design out of numerically the same cogs and springs, over and against the counter-claim that H is merely a similar watch assembled to the old design out of numerically the same cogs and springs? These questions may be answered simply by saying that when one has such-and-such object-slices caused in such-and-such a way one has the one object.

The possible further objection, 'So according to you it wouldn't have made made any difference to the identity of X if, instead of the  $p, t_3 - t_4$  object-slice, O had produced a similar but numerically different object-slice at that location,' cannot be given any clear sense in terms of our identity criteria for object-slices.

Furthermore, my arguments above are quite consistent with the use of the following criterion: Physical object M is identical with physical object N if and only if it is possible that M and N should exist at the same time, but not possible that they should exist beside each other at the same time. This being so, identity without continuity does not reduce to similarity.

I conclude that Nerlich has failed to demonstrate that spatio-temporal continuity is a logically necessary condition of the identity of physical objects.

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