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Review

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Review by: Steven French

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Paul Horwich, *Asymmetries in Time* (Cambridge, Mass.: MIT Press, 1987), xiii + 207 pp., \$22.50 (cloth), \$9.95 (paper).

STEVEN FRENCH

SOUTHEAST MISSOURI STATE UNIVERSITY

How the words of St. Augustine must ring in the ears of anyone who attempts to deal with the nature of time! How can we even begin to come to grips with its enigmatic character without falling into either triviality or obscurity?

Horwich's book represents a clear, thoughtful and, above all, honest attempt to answer this question and dispel some of the mystery, by looking at the way time, in particular in its directional or asymmetric aspect, is intimately tied up with some of the most basic components of our conceptual scheme. To this end the work is set out in the form of an exploratory map, with the twin aims of following the interconnections between diverse temporally asymmetric phenomena and secondly, but more fundamentally perhaps, looking for some more basic 'fact' upon which they all depend, in one way or another. Its central thesis, around which the various arguments are organized, is that we have no reason to believe that time itself is asymmetric. Thus, the explanation of temporally asymmetric phenomena must lie elsewhere and Horwich sees it as residing, primarily, in what he calls the 'fork asymmetry', which is in turn grounded in certain cosmological initial conditions.

After a brief outline of the route to be followed, the discussion proper begins with an incisive attack on the metaphysical picture of temporal asymmetry painted by the 'moving now' conception of time, together with the so-called 'tree' model of reality (Chapter 2). It is then argued (Chapter 3) that there is no evidence for any intrinsic difference between the past and future directions as manifested via some temporal asymmetry in the laws of nature, with 'de facto' irreversible processes explained in terms of some, admittedly speculative, cosmology concerning randomness in the microscopic conditions following the Big Bang (Chapter 4). These conditions also underpin what Horwich calls the 'V-correlation' phenomenon: correlated event types are always (or 'often'—there is some unfortunate ambiguity here) associated with some antecedent event within a V-shaped pattern of nomological determination. The truth of this, together with the falsity of its time reverse, that is, correlated events are never ('rarely') associated with some characteristic subsequent event, gives the 'fork asymmetry' principle which forms the corner-stone of his account as a whole.

Thus it explains (Chapter 5) why we know more about the past than the future and generates our conception of temporal order, regarded as a 'built-in' component of the notion of explanation (Chapter 9). With this notion held to be theoretically prior to causation, the time bias in the former gives us the future orientation of the latter (Chapter 8). Counterfactual

dependence can then be accounted for in 'Goodman-like' terms (Chapter 10), with causal notions employed in the specification of underlying prevailing conditions. Finally, the knowledge asymmetry also gives rise to our tendency to act for the sake of the future and in Chapter 11 Horwich defends a form of the evidential approach to rational choice.

Together with all this we get two chapters on backward causation (Chapter 6) and time travel (Chapter 7), which give perhaps the clearest discussion of these ideas to date. As regards the first, Horwich argues for its conceptual possibility, although with certain acute theoretical disadvantages attendant on its being postulated in actual cases. 'Gödelian' time travel via closed causal chains remains plausible, however, with the familiar arguments regarding 'self-defeating' activities showing how our own history must be out of bounds to us.

So, there's something for everyone here and on the whole Horwich keeps the discussion on a nicely even keel. However, the amount of space devoted to Lewis' theory of counterfactuals is rather an indulgence for a book of this kind and the Reichenbach-Grunbaum approach to one-way processes etc. is dismissed a little too quickly in comparison. More could also have been said on the empirical question of temporal asymmetry. In particular, the challenge to isotropy represented by the failure of CP invariance in particle physics deserves a little more attention than it gets, given the known difficulties in constructing alternative explanations of the phenomena involved.

However, this is to carp on essentially minor points. Of a more serious nature is the criticism that quantum mechanics presents us with examples of correlations which clearly appear to violate the all-important principle of the fork asymmetry. This is a well known problem in the context of 'common cause' theories of explanation, to which Horwich's account is obviously closely related, as he himself admits. However, the suggestion that we should regard the 'common cause principle' as a methodological principle only (Sober 1987) is clearly inadequate here (and even if adopted in the context of explanation still leaves the problem of 'explaining', in some sense, these quantum correlations).

Thus, for example, in Chapter 6, Horwich argues that, in the case of tachyons and Feynmann's theory of positrons, there is a conceptual price to pay for the introduction of backward causation type interpretations. 'An entrenched commitment, beyond the principle that causes precede effects, would have to be given up—namely, the principle that correlated events are causally connected.' (p. 106). However it is exactly this price which quantum mechanics seems to demand that we pay.

Given the vast amount of recent work on this topic, transcending the usual 'interpretational difficulties', and given Horwich's perceptive treatment of the scientific issues involved in other cases, it is surprising that he fails to discuss this problem, or even to mark it down as a possible challenge to the basis of his whole account.

A further point concerns the source of the fork asymmetry, given in terms of a cosmological 'initial micro-chaos' condition. Although it is stated that nothing in the rest of the book explicitly depends on these specula-

tions, it is not clear how seriously we are to take them, since they emerge at the end (p. 205) as part of the general explanation of the temporally asymmetric phenomena considered (and are even given the accolade of 'facts' on at least two occasions; p. 78 and p. 201). Furthermore, it seems that Horwich needs the above condition to show that thermodynamic irreversibility is just a special case of the fork asymmetry.

At the very least there is some ambiguity here as to the role these speculations are supposed to play and one might question the wisdom of mixing philosophy and cosmology together in such a highly volatile fashion. (Thus we might feel entitled to ask what happens to these speculations if the big bang context, in which they are located, is replaced by the steady state theory, recently given new life by the inflationary universe model? Horwich himself notes, in the conclusion (Chapter 12) that further work is needed to bring his speculations into some kind of consonance with current physical theory—given that cosmology is itself still a rather speculative affair, this might turn out to be an elusive goal to aim for!) Searching for a more philosophical, or conceptual, basis for the 'V-correlation' principle might, perhaps, be a more secure route to follow.

Nevertheless, I find myself very much in sympathy with Horwich's philosophical approach in general. His emphasis on the distinction between metaphysical and epistemological questions, between explaining a fact and explaining why we should believe it (carried over from his other works) is particularly attractive and put to good use in the discussion of causality, for example. More generally, his continual evaluation of the plausibility of the various hypotheses etc. considered brings everything out into the open and makes for a very clear, sharp analysis. It is all very well written, as we have come to expect from the author, and the relevant issues are engaged in a fresh, if at times provocative, manner. Thus there is much to recommend in this work and although to call it *the* book on time would perhaps be going a little too far, it is most certainly a well thought out, profound and, ultimately, important contribution to the subject.*

NOTE

*Although I realise this is unusual for a book review, I really must thank my research student Alfredo Pereira Jr. for many useful discussions on this topic.

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1987 'Explanation and Causation (review of Wesley Salmon: *Scientific Explanation and the Causal Structure of the World*)', *British Journal for the Philosophy of Science* 38 pp. 243-267.