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REVIEW

PHIL DOWE
Physical Causation
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Phil Dowe, in *Physical Causation*, addresses such questions as 'What are causal processes and interactions?', 'What is the connection between causes and effects?', and 'What distinguishes a cause from its effect?' Dowe not only provides explicit and original answers to these questions, but, *en route*, provides important critiques of alternative answers as well as sophisticated discussions of negative causation, the fork asymmetry, and quantum mechanics. Those familiar with Dowe's previous publications on causation will find the most detailed statements of his various views to date, along with several new ideas, all now interwoven into a unified approach. In virtue of its original, sophisticated, and unified discussion, *Physical Causation* should play a major role in subsequent discussions of causation.

Dowe adopts a somewhat unusual methodology, seeking to discover only the contingent facts about how causation works at the actual world, relegating conceptual analysis to a distinct, complementary, but unpursued role. Dowe's contingent accounts of causal processes, the causal connection, and the causal order are, then, as follows:

Causal Processes: (CQ1) A *causal process* is a world line of an object that possesses a conserved quantity, and (CQ2) A *causal interaction* is an intersection of world lines that involves exchange of a conserved quantity (p. 90).

Causal Connection: The states-of-affairs Fa and Gb are causally connected iff there is a set of causal processes and interactions between Fa and Gb such that (CC1) any change of object from a to b and any change of conserved quantity from F to G occur at causal interactions involving the following changes: ΔFa, ΔFb, ΔGa, ΔGb; and (CC2) for any exchange in (CC1) involving more than one conserved quantity, the changes in quantities are governed by a single law of nature (pp. 171–2).

Causal Order: Fa is causally prior to Gb iff (CO1) Fa and Gb are on a causal process containing at least one conjunctive fork open towards Gb and none open towards Fa, or (CO2) if (CO1) fails, then Fa and Gb can be located in a global net of causal connections containing at least one conjunctive fork open in the direction of Gb, and none open in the direction of Fa (pp. 194–206).

The reader interested in further explication of these definitions is invited, of course, to refer to *Physical Causation*.

Any book of such clarity and originality is bound to provoke critique, and I will briefly mention a few more problematic aspects of Dowe's views.

Methodology: Dowe's methodological focus on contingent specification may leave the reader feeling unsatisfied. Dowe describes his explication of causal processes in terms of conserved quantities as 'a plausible conjecture' (p. 94), but the line between plausible conjecture and lucky guess seems faint. The reader may well wonder, for instance, what it is about our concept of process that makes conserved quantities appropriate for their actual specification. Such a reader, however, may well find Dowe's plausible conjectures to be a useful guide in attempting a general understanding of the concepts involved. (For instance, one might think that, because conservation laws govern the nomic evolution of closed systems, the concept of process is connected to the concept of lawful sequence.)

Processes: Dowe's contingent specification of what processes are is problematic on at least two points. First, the account presupposes a primitive notion of object identity-through-time in order to trace world lines correctly. If one thinks of identity-through-time as involving a causal interrelation between stages of the object, then one will fear circularity (Dowe discusses this concern, pp. 101–9). In any case, this presupposition raises the question of why Dowe doesn't just take causation as primitive, especially since his point that scientists succeed in tracking objects (p. 108) applies equally to causal relations. The Humean, for instance, has a principled way of ruling out certain primitives (no necessary connections); but it is not clear to me what, if any, principled view of primitives is at work here.

Second, Dowe's account invokes the notion of a conserved quantity, which is 'any quantity that is governed by a conservation law' (p. 91). But a conservation law, as Dowe is aware (p. 95), is standardly glossed as a law which holds *in a closed system*, and what is a closed system other than a causally isolated one? To this Dowe replies that 'Instead we need to explicate the notion of a closed system in terms only of the quantities concerned. For example, energy is conserved in chemical reactions, on the assumption that there is no net flow of energy into or out of the system' (p. 95). I do not see what alternative explication of a closed system Dowe is offering, and his assumption of no net energy flow looks to invoke the very notion of 'flow' that the process account is supposed to analyze.

Causal connection: Dowe's contingent specification of causal connections in terms of process-linkage is problematic in excluding causation by disconnection. Suppose, for example, that Kim lops off Vic's head (C), causing Vic to die (E). One's brain is normally kept alive by an influx of oxygenated blood, and the way in which lopping of the head causes death is by disconnecting this oxygenation process, thereby starving the brain cells. Thus the basis for the causation between C and E is not any process-linkage from C to E, but rather the way C shields E by disrupting some other process (the oxygenation of Vic's brain) that would otherwise have prevented E.

Intuitively, such disconnections seem clearly causal. This intuition can be buttressed by the following considerations. Statistically, head-loppings in such circumstances will be universally followed by deaths. Counterfactually, had Kim not lopped off Vic's head then Vic would not have died (then). The explanation for why Vic died will surely include Kim's actions. Knowing that Kim lopped off Vic's head will license an inference to Vic's death. Head-loppings in such circumstances are an effective means for murderous agents. Kim will be held morally responsible for Vic's death. In summary, all of the connotations of causation are in full force.

Now Dowe has a chapter-length response to the problem of disconnections, which is to offer an ersatzist account of negative causation as 'causation*', based on counterfactuals about causation. So he would say, in the example above, that (1) C causes* $\sim$D (where D is the oxygenation of your brain), and (2) that $\sim$D causes* E.

But this response is problematic in two main ways. (a) Dowe's account of causation* is unsuited to Dowe's own account of causation, as the former requires an account of how causation works beyond the actual world. Dowe describes his account of causation* as a 'cross-platform solution' in that virtually any account of causation can be plugged in. *But Dowe's can't*. Since Dowe has only offered a contingent specification of how causation operates in the actual world, he has yet to say how causation operates in those nonactual worlds that his counterfactuals take us to (here a conceptual analysis is needed).

Nor is there any hope in thinking that these nonactual worlds are close enough so that Dowe's contingent specification should still apply. For on the standard way of evaluating counterfactual suppositions, we delete or insert the antecedent conditions with minimal modification to the rest of history, in which case the conservation laws that Dowe's account relies on will almost certainly turn out to be false. (Elsewhere Dowe is quite willing to take worlds whose laws are just like ours, but with nonsymmetric spacetimes, as not covered by his account, since 'Symmetries and conservation laws that hold in the actual world break down' [p. 98].)

Worse, (b) Dowe's account of causation* is semantically unstable. Dowe has offered us two relations, one (that of process-linkage) which he labels 'causation', and the other (that of counterfactuals involving the first) which he labels 'causation*'. For the sake of neutrality I will relabel these relations 'R1' and 'R2' respectively, and I will assume that we have some general analysis of R1 (perhaps guided by Dowe's contingent specification) that applies across worlds. Now we can ask the semantic question as to whether R1 or R2 is really more deserving of the title 'causation'. Here I think that it is R2 which is the knock-down winner—R2 covers cases of causation by disconnection (such as dying because one's head is lopped-off) and thereby squares with the statistical, counterfactual, explanatory, evidential, decision-theoretical, and moral connotations of causation. Indeed Dowe grants that it is R2 that plays the role of 'causation' in evidence, explanation, and agency (p. 145). So if one adopts anything like the Ramsey-Carnap-Lewis account of theoretical terms, it will thereby turn out that R2 is a far better satisfier of the 'causation' role than R1.

For those of us who insist that the causation by disconnection is genuine causation, this point actually suggests a way of recalibrating Dowe's account, on which we adopt some generalized notion of process for R1, and then analyze (genuine) causation in terms of counterfactuals about process-linkage as per R2. If so, then Dowe has provided the theoretical underpinnings for understanding causation by disconnection, albeit in different terms than he proposes.

Causal Order: Dowe's account of the causal order seems conflicted. Dowe dismisses the temporal account of the causal order on the grounds that 'backwards causation may one day find a place in physical theory' (p. 188), for which his primary example is the backwards causation model of the Bell phenomena in quantum mechanics. But Dowe's own positive account in terms of the fork asymmetry is not well-suited to the backwards causation model of the Bell phenomena. The Bell phenomena, after all, do not involve any known past-open forks containing the measurement made at t1 and the entangled state at t0—there is no second tine at t0. The reason for adopting the backward causation model is thus not the identification of any past-open fork, but rather to provide a causal explanation for a statistical correlation that resists explanation in forward-causal terms.

Now Dowe recognizes this conflict, and claims that it furnishes an empirical test for his theory: we should be able to find some further correlated event to serve as the missing tine at t0 (Dowe playfully suggests an itch felt by the experimenter during the set-up [p. 206]). I think Dowe is making the most of a difficult situation. It seems that he has two very different conceptions of the causal order (the official fork asymmetry story, and the unofficial story implicit in the backwards causation model of the Bell phenomena), and no reason at all to suppose that they even contingently coincide.

Perhaps Dowe has a better way to go here. His official account of the causal order is a weighted disjunction of the local and global direction of open forks. If we understand the motivation for the backwards causation model of the Bell phenomena in terms of statistical correlations that resist explanation by causal hypotheses from one direction, and see such consideration as taking priority over the direction of open forks, then we can consider expanding Dowe's weighted disjunction by giving primary weight to providing causal explanations for statistical correlations, secondary weight to the local direction of open forks, and tertiary weight to the global direction of open forks.

In summary, *Physical Causation* is a very good book. It is original, provocative, and insightful. It advances the discussion at several places. While I have expressed a few doubts as to the specific recommendations Dowe makes, there should be no doubt as to the overall importance of his work.