Review of *Physical Causation* by Phil Dowe (Cambridge University Press, Cambridge, U. K., 2000, 234 p.)

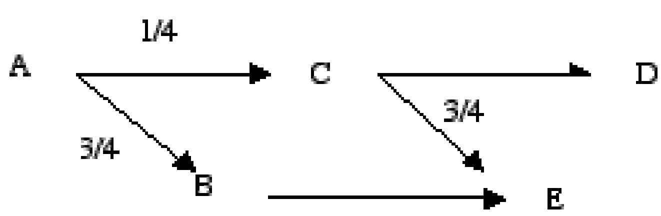
By Robert C. Koons, Professor of Philosophy, University of Texas, Austin

In *Physical Causation*, Phil Dowe proposes a Conserved Quality account of causation and offers criticisms of several alternatives, including Humean, counterfactual, and mark transmission accounts. Dowe eschews "conceptual analysis" and instead offers his theory as an "empirical account of causation at it is in the actual world." Dowe takes this as absolving him of the responsibility of giving an account of the essence of causation, threatening to turn his metaphysical account into a watered-down version of more-or-less contemporary physical theory. Nonetheless, on the basis of the strength of many of the criticisms of alternatives, I can recommend this book to anyone interested in contemporary debate about causation.

Dismissive of conceptual analysis, Dowe often gives no weight to ordinary usage or "folk intuitions". [1] However, he is not consistent in this disavowal. For example, on page 91, Dowe argues that our ontology should include anything found in the ontology of science *or common sense*. If common sense is a reliable guide to ontology, why is it an entirely unreliable source of intuitions about causation? (See similar appeals on p. 23, p. 36, and pp. 124-5.) When his theory runs into any conflict with common-sense intuitions, he lightly dismisses them as irrelevant but readily appeals to them when needed to defend his own account against a rival.

The real issue is not whether philosophy should start or finish with "conceptual analysis" or be "empirical" through and through. The real issue is this: what should count as *data* for our metaphysics? Should we count only the results of fundamental science or should we assume that we have non-technical knowledge of the world, in part implicit in the structure of ordinary language?.

Dowe provides an excellent statement of the case against regularity, counterfactual, and probability-raising accounts of causation. He relies upon the following schema of particle decay:



Event A represents the existence of an atom of type a, which can decay either into an atom of type c (event C) or of type b (event B), with probabilities of one-fourth and three-fourths, respectively. An atom of type b decays immediately with probability one to an atom of type e (event E), while the atom of type C may decay either into an atom of type

[1] See pages 6, 43, 96-98, 104, 172, and 206.

e (with probability 3/4) or into type D (probability 1/4). The actual sequence of events is A-C-E. Intuitively, we want to say that C is a cause of E, since C consists of the production of the c-type atom whose decay into an e-atom is event E. However, the occurrence of C actually lowers the probability of E: P(E/C) = 3/4, while P(E/-C) = 1.

Dowe overlooks the possibility of a non-counterfactual probabilistic account, of the kind developed recently by Yablo,[2] Zimmerman,[3] and myself,[4] building on Mackie's idea of an INUS condition (insufficient but necessary part of an unnecessary but sufficient condition). If the "sufficiency" of the sufficient condition is understood in probabilistic terms (i.e., as being a condition that gives the effect an objective probability of at least q, for some constant q > 0), and if the "necessity" of the part of the condition is understood not counterfactually but mereologically, i.e., as being a part whose subtraction from the whole leaves a condition that no longer confers a probability of at least q on the effect, then the INUS analysis can give the correct account of Dowe's decay example. Event B is irrelevant, since it is not actual. Event C is a condition that gives E an objective probability of 3/4, this tendency is not defeated by any actual condition, and there is no proper part of C that has this property. Hence C is a "necessary part" of itself with respect to the requirement of giving E at least a 3/4 probability, and C counts as an actual cause of E.

Dowe's positive account is an extremely simple one, drawing on earlier proposals by Aronsen and Fair.

1) A *causal process* is a world line of an object that possesses a conserved quantity.
2) A *causal interaction* is an intersection of world lines that involves exchange of a conserved quantity.

I doubt that Dowe's conserved quantity account will work, even for the very narrow task of characterizing causal interactions in physics. There are principles other than conservation laws, such as Pauli's exclusion principle, that play a central role in certain causal processes. In any case, it is clear that we need laws about how and when the conserved quantities are exchanged. A complete account of physical causation must provide an account of what such "exchanges" consist in. Although Dowe mentions Ehring's trope-persistence account, he rejects without argument the promising idea that a numerically identical energy- or momentum-trope is transferred from one object to another in such an exchange.

In Chapter 6, Dowe considers what I take to be the decisive objection to his theory: that it cannot provide an adequate account of preventions. Dowe appeals to our intuition of difference between prevention and first-class causation. However, I think this intuition disappears when we consider causation by double prevention (by preventing a preventer).

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[2] "Mental Causation," *Philosophical Review* 101 (1992):245-280.

[3] "Immanent Causation," Philosophical Perspectives 11 (1997):433-471.

[4] *Realism Regained: An Exact Theory of Causation, Teleology and the Mind* (Oxford University Press, New York, 2000).

However, this is not the critical issue. If Dowe could successfully give an account of preventions by first giving an account of "first-class", quantity-transferring causation and then by defining preventions as a kind of "second-class" causation, I would not object. However,. his definition of prevention is vulnerable to exactly the same objections that Dowe himself lodges against counterfactual accounts of causation.

Here is Dowe's account of prevention (p. 132):

A prevented B iff

(P1) A occurred and B did not, and there is an x such that:

(P2) Either A is or A causes a causal interaction with x, and

(P3) If A had not occurred, then x would have caused B.

This account of prevention suffers from exactly the problems besetting counterfactual analyses of causation. Suppose, for example, that A prevented B, but also prevented C, which would have, in the absence of A, prevented B. Then, A is indeed a preventer of B, but clause (P3) fails, since if A had not occurred, C would have, and C would then have prevented B.

Dowe explicitly recognizes this problem, and he then proposes a "correction" to his definition that is a non-starter. He suggests that we simply add to (P3) a disjunction (P3'):

(P3') or there exists a C such that had neither A nor C occurred, then x would have caused B.

However, this "correction" makes almost any event a preventer of B. Suppose that C actually prevents B, nothing else prevents B, and A is some actual event causally irrelevant to B and C. Then, if neither A nor C had occurred, x would have caused B, since the actual preventer C has been removed. Thus, (P3') has the implication that anything causally irrelevant to B prevents B. This isn't a minor slip – I can't see how to repair (P3') without introducing some other absurd consequence. Suppose, for example, that we tried (P3*):

(P3*) or there exists a C such that had neither A nor C occurred, then x would have caused B, but had either A or C occurred, x would not have caused B.

This is somewhat better than (P3), but it means that Dowe cannot distinguish actual preventers from preempted, back-up preventers. If A actually prevented B, and C did not actually prevent B but would have prevented had A not occurred, then (P3*) will wrongly identify both A and C as actual preventers of B.

In probabilistic cases, the analogue of Dowe's account (a chance-lowering theory of prevention) will have defects exactly symmetrical to those that Dowe pointed to in Suppes's chance-raising theory of causation. Look again at Dowe's decay model, and suppose that event E is a negative event (the non-occurrence of some event F). Event C prevented F's occurrence, despite the fact that the occurrence of C actually raised the probability of F's occurrence.

Dowe recognizes another problem with his account, if it is taken as a *sufficient* condition of causal connection: the problem of "misconnections" (page 146). There is a chain of quantity-conserving processes linking the fat child to the thin adult (to use Papineau's example), but surely the first does not cause the second.

Dowe considers and rejects a number of hybrid accounts that combine a physical-process condition with a counterfactual chance-raising condition. He finds that all such hybrids combine the vices of both accounts with the virtues of neither. These hybrids fail a discrete-time version of the decay case test – a version according to which there are no temporal moments between the events A, C and E.

Dowe also uses this case to offer persuasive objections to Lewis's account of quasi-dependence and Menzies's similar functionalist-style account. Suppose that c-atoms are typically produced by the decay of a-atoms. Then it still would be the case that C-like events actually cause E-like events, even though C-like events *typically* lower the probability of E-like events.

Dowe's own positive account of causal connection demands that we track the changes in conserved quantities in the objects involved. The relata of causation are identified as facts or events of the form: *the quantity q of object a takes value x*. One fact or event of this form is causally connected to a second just in case there is a chain of quantity transfers, each of which is governed by a single law of nature. I find Dowe's proposal to be incomplete. He claims that "no deep account of laws is required here – simple covariance will suffice." (p. 172) However, Dowe's account turns critically on the question of when one or more than one law is involved. I have no idea how to count the number of "simple covariances" involved in a single case, if this means Humean universal generalizations.

In addition, Dowe seems to assume that the dynamical laws at work are deterministic, because, if they were irreducibly probabilistic, his account would encounter the very problem about singular causal connections in cases of multiple, independent chance-raisers that Dowe urged as an objection to another hybrid account (p. 168). Suppose for example, that we had events C', C", E', and E", in which each of C' and C" have a one-half probability of transferring the same quantity of energy to either E' or E". In fact, both C' and C" lose this quantity, and each of E' and E" gain it. The facts about quantities possessed and about the laws of conservation are equally consistent with two distinct possibilities: (i) that C' caused E' and C" caused E", and (ii) that C' caused E" and C" caused E'. Nothing in Dowe's theory can account for this difference in causal connection.

Dowe's chapter on the direction of causation approaches the matter from a new angle: an interpretation of quantum mechanics involving backwards-in-time causation. Dowe argues that the theory of backwards-causation makes an empirically confirmable prediction: that a conjunctive fork open to the past be discovered in quantum phenomena. Such a fork would involve three events: a later measurement event Ma that caused two earlier, widely separated events S and x.

The crucial question is this: wouldn't the presence of such an empirically observable time-reversed fork lead to the logical paradox of the "bilking problem"? In this case, couldn't one check to see whether x and S occur, and, if they do, act so as to prevent their supposed later cause, Ma?

Dowe's response is that one couldn't tell whether S (one of the effect) had occurred until observing its later cause, Ma. The event S includes, not just the observable separation of two particles, but also some "hidden part" (p. 207) caused by Ma,. The in-principle indetectability of S would seem to contradict Dowe's claim that such a case could provide *empirical* confirmation of backwards causation.