Phil. 256: Becausal Relations
Oct. 13, 2021

Meeting 6: Unifying Grounding and Causation? (Pt. 1)

I. Schaffer on Similarities between Grounding and Causation

According to Schaffer, grounding is "often" glossed as a metaphysical form of causation by "many" theorists (by which he means: two theorists, other than himself) (pp. 50, 54).

Six points of analogy between causation and grounding emphasized by Schaffer (pp. 54–57):

- Both relations are aptly described using 'generation', 'production', 'making', and 'dependence' talk.

- Both are standardly regimented as *irreflexive*, *asymmetric*, and *transitive* two-place relations.

- Both relations apply at the level both of *token* (as: "This short circuit caused that fire"; "This H, H, and O arrangement grounds that drop of water") and of *type* (as in: "Short circuits can cause fires"; "H, H, and O arrangements ground water").

- For both relations, one can draw a *component* versus *net* distinction.

    In the case of causation, one factor can contribute positively toward a given effect while another (or even the same) factor contributes negatively, where the net effect is determined "by summing these components" (p. 55).

    In the case of grounding, we supposedly find the same thing. For example, [10 is not prime] and [11 is prime] are "mixed (and equally weighed) components" in the truth-value determination of [Most two-digit numbers are not prime], with the first positive contributing toward and the second negatively contributing against that generalization being the case.

        problem: Here Schaffer is exactly assuming *the metaphysical-force-vector model of grounding* that we saw some reasons to doubt two weeks ago.

- For both relations, one can draw a distinction between *incomplete*, *complete*, and *total* factors.

    Suppose Ann and Ben jointly row a boat through the tape at the race's finish line at the same time that Clare and Dave jointly row a boat through the tape. Then:

        Ann's rowing is *an incomplete cause* of the tape's breaking.

        Ann's rowing and Ben's rowing are together *a complete cause* of the tape's breaking.

        Ann's rowing, Ben's rowing, Clare's rowing, and Dave's rowing are together *the total cause* of the tape's breaking.

    Similarly, suppose [p], [q], [r], and [s] all obtain. Then:

        [p] is *an incomplete* (i.e. partial) *ground* of [$(p \,\&\, q) \vee (r \,\&\, s)$].

        [p], [q] are *a complete* (i.e. full) *ground* of [$(p \,\&\, q) \vee (r \,\&\, s)$].

        [p], [q], [r], [s] are *the total ground* of [$(p \,\&\, q) \vee (r \,\&\, s)$].

    (But what if [p] is fully grounded in [o]? Do we also want to say that [o], [q], [r], [s] is another total ground? Or do we instead want to say that the total ground includes at least [o], [p], [q], [r], and [s]? Similarly, if events *ee* are a complete cause of Ann's rowing, do we want to say that *ee*, Ben's rowing, Clare's rowing, Dave's rowing are a total cause of the tape's breaking?]

- For both relations, there is a natural idea of *screening-off*: if a causes/grounds b, and b causes/grounds both c and d (but doesn't cause/ground c by way of d, or vice versa), then "holding fixed" the presence of b, c becomes "plausibly independent of" a and d (p. 57).

II. Schaffer on Structural Equation Models of Causation

Here is Schaffer's way of understanding the popular *structural equations model* approach to causation, when we simplify matters by considering only finitely many variables and assuming determinism:

First, we define a signature **S** = <**U**, **V**, **R**>, where:

U is a finite set of exogenous variables representing the independent (or initial) conditions;

V is a finite set of endogenous variables representing the dependent conditions;

R is a function mapping each variable in **U** ∪ **V** to a two-or-more-membered set of allotted values, where each value represents the obtaining or not obtaining of some event, and each such event is wholly distinct from every other such event.

Second, we define a linkage **L** = <**S**, **E**>, where **S** is the signature just specified, and where:

E is a set of structural equations of the form "$V := f(U_1, \ldots, U_n)$," for every $V \in$ **V**, such that (i) each $U_i \in$ **U** ∪ **V**, (ii) these U_i count as V's parents, and (iii) no V stands in the ancestral of the parenthood relation to itself (a global acyclicity or "no loops" constraint).

Third, we define an assignment **M** = <**L**, **A**>, where **L** is the linkage just specified, and where:

A assigns a value to every exogenous variable $U \in$ **U**.

By way of illustration, Schaffer provides the following (ludicrously simplified) structural equation model of a rock thrown through a window:

$\mathbf{S}_1$ = <$\mathbf{U}_1$ = {*Throw*}, $\mathbf{V}_1$ = {*Shatter*}, $\mathbf{R}_1$>, where $\mathbf{R}_1$ maps *Throw* to {0, 1} with 1 representing the rock's being thrown and 0 representing the rock's not being thrown, and maps *Shatter* to {0, 1} with 1 representing the window's shattering and 0 representing the window's not shattering.

$\mathbf{L}_1$ = <$\mathbf{S}_1$, {*Shatter* := *Throw*}>.

$\mathbf{M}_1$ = <$\mathbf{L}_1$, {*Throw* = 1}>.

A given linkage can be represented as a directed graph in which (a) each variable is a vertex, and (b) if variable $U \in$ **U** ∪ **V** is a parent of variable $V \in$ **V**, then there is directed edge from U to V.

Let us define the notion of an "intervention" on a model **M** = <**L**, **A**> as follows:

Let **I** = $\{X_1 = x_1, \ldots, X_m = x_m\}$, where $\{X_i\}$ is some subset of **M**'s variables (so each $X_i \in$ **U** ∪ **V**). Then the intervention of **I** on **M** is a new model, **M***, which is constructed as follows:

1. *Cut any incoming links*: For any X_i such that $X_i \in$ **V**, (i) delete X_i from **V** to obtain **V***, (ii) insert X_i into **U** to obtain **U***, and (iii) delete the equation in **E** with X_i on the left to obtain **E***.
2. *Reassign the stipulated values*: For each variable X_i in **I** (all of which are now in **U***), modify the assignment **A** into **A*** by assigning X_i to the value specified in **I**.
3. *Obtain the modified model*: **M*** = <**L***, **A***>, where **L*** = <**S***, **E***>, and **S*** = <**U***, **V***, **R**>.

We can then define the notion of an "intervention counterfactual" as follows:

"If $X_1 = x_1, \ldots, X_m = x_m$, then $Y_1 = y_1, \ldots, Y_n = y_n$" is true in **M** iff $Y_1 = y_1, \ldots, Y_n = y_n$ are true in the intervention, **M***, of $\{X_1 = x_1, \ldots, X_m = x_m\}$ on **M**.

Finally, Schaffer proposes the following:

contrastive counterfactual test for causation: If there is a direct $X \to Y$ path, and no other distinct path to Y, then: $X = x$ rather than x^* is a token cause of $Y = y$ rather than y^* iff both "If $X = x$, then $Y = y$" and "If $X = x^*$, then $Y = y^*$" are true.

III. Schaffer on Structural Equation Models of Grounding

Schaffer claims that we can use almost exactly the same formalism to model grounding, provided we make the following three tweaks to it:

- The exogenous variables now represent the *fundamental* conditions rather than the *initial* conditions.
- The value of each variable now represents *any entity that can ground or be grounded*, not just *events*.
- All we require is that those entities be *non-identical*, not that they be *distinct* (since *being distinct* was best interpreted as *being neither identical, nor grounding each other, nor having a common ground*).

Putting all of this together, we get the following (for a given model **M**):

> *contrastive counterfactual test for grounding*: If there is a direct X $\rightarrow$ Y path, and no other distinct path to Y, then: X = x rather than x^* is a token ground of Y = y rather than y^* iff both "If X = x, then Y = y" and "If X = x^*, then Y = y^*" are true.

Here are some examples of this formalism in action:

- A model that yields the result "The shirt's being maroon rather than navy grounds the shirt's being red rather than blue":

  $\mathbf{S}_2$ = <$\mathbf{U}_2$ = {*Determinate*}, $\mathbf{V}_2$ = {*Determinable*}, $\mathbf{R}_2$>, where $\mathbf{R}_2$ maps *Determinate* to {0, 1} with 1 representing the shirt's being maroon and 0 representing the shirt's being navy, and maps *Determinable* to {0, 1} with 1 representing the shirt's being red and 0 representing the shirt's being blue.

  $\mathbf{L}_2$ = <$\mathbf{S}_2$, {*Determinable* := *Determinate*}>.

  $\mathbf{M}_2$ = <$\mathbf{L}_2$, {*Determinate* = 1}>.

  Note that we would not obtain this result if we included a value representing the shirt's being crimson in the set to which $\mathbf{R}_2$ maps *Determinate*. But Schaffer might reply that this the correct result, since "The shirt's being maroon rather than crimson, or navy, or . . . grounds the shirt's being red rather than blue, or yellow, or . . ." is not true.

- A model that yields the result "∅'s existing rather than not existing grounds {∅}'s existing rather than not existing":

  $\mathbf{S}_3$ = <$\mathbf{U}_3$ = {*Empty*}, $\mathbf{V}_3$ = {*Singleton*}, $\mathbf{R}_3$>, where $\mathbf{R}_3$ maps *Empty* to {0, 1} with 1 representing ∅'s existing and 0 representing ∅'s not existing, and maps *Singleton* to {0, 1} with 1 representing {∅}'s existing and 0 representing {∅}'s not existing.

  $\mathbf{L}_3$ = <$\mathbf{S}_3$, {*Singleton* := *Empty*}>.

  $\mathbf{M}_3$ = <$\mathbf{L}_3$, {*Empty* = 1}>.

  Note that in order for "If *Empty* = 0, then *Singleton* = 0" to be true in this model, we need to consider a countermetaphysical (not just counterfactual) intervention in which ∅ does not exist.

- A model that (supposedly) yields the result "[p] rather than [$\sim p$] and [q] rather than [$\sim q$] each partially ground [p & q] rather than [$\sim(p$ & $q)$]":

  $\mathbf{S}_4$ = <$\mathbf{U}_4$ = {P, Q}, $\mathbf{V}_4$ = {*Conj*}, $\mathbf{R}_4$>, where $\mathbf{R}_4$ maps P to {0, 1} with 1 representing p and 0 representing $\sim p$, maps Q to {0, 1} with 1 representing q and 0 representing $\sim q$, and maps *Conj* to {0, 1} with 1 representing p & q and 0 representing $\sim(p$ & $q)$.

  $\mathbf{L}_4$ = <$\mathbf{S}_4$, {*Conj* := *min*(P, Q)}>.

  $\mathbf{M}_4$ = <$\mathbf{L}_4$, {P = 1, Q = 1}>.

Note that if we want to extend this model to account the grounds of [(p & q) & (r & s)], we need to include three separate structural equations for each conjoining operation, whereas it would have been more elegant to include a single structural equation that encompasses all instances of conjunctive grounding within our model.

- A model that (supposedly) yields the result "[p] rather than [$\sim p$] and [q] rather than [$\sim q$] each fully ground [$p \vee q$] rather than [$\sim(p \vee q)$]":

  $\mathbf{S}_5$ = <$\mathbf{U}_5$ = {P, Q}, $\mathbf{V}_5$ = {*Disj*}, $\mathbf{R}_5$>, where $\mathbf{R}_5$ maps P to {0, 1} with 1 representing p and 0 representing $\sim p$, maps Q to {0, 1} with 1 representing q and 0 representing $\sim q$, and maps *Disj* to {0, 1} with 1 representing $p \vee q$ and 0 representing $\sim(p \vee q)$.

  $\mathbf{L}_5$ = <$\mathbf{S}_5$, {*Disj* := *max*(P, Q)}>.

  $\mathbf{M}_5$ = <$\mathbf{L}_5$, {P = 1, Q = 1}>.

  Note that we cannot get our desired result by applying the *contrastive counterfactual test for grounding*, because there are multiple direct paths to *Disj*, so the principle's antecedent is not satisfied. "But virtually every plausible extension of the counterfactual dependence test agrees on the grounding result in this case," Schaffer tell us (p. 79)

Three reservations I have about Schaffer's formalism, in increasing order of significance:

1. *Schaffer touts the precision and power of his structural equations model of grounding, but the simplicity of his examples makes it difficult to appreciate whether this formalism comes with any pay-off.*

   After all, pretty much any philosophical theory can be "formalized" via a representation of that theory in which we assign 0's and 1's to all of its elements.

   It would have been nice if he had provided some examples where his formalism yields new verdicts about what grounds what in cases where we were unsure which way to go, or where his formalism convinces us that some grounding claim we thought was false is in fact true.

2. *Without knowing how to apply the formalism in cases of overdetermined grounding (which are rife), it's difficult to figure out how the proposal is even supposed to work.*

   This crucial unclarity also makes it difficult to construct counterexamples to the formalism, but I am fairly confident that any way of extending the counterfactual dependence test to cases of overdetermined grounding will yield counterexamples of the standard sort that arise for appeals to counterfactuals in philosophy (where, say, what it takes to hold one variable fixed makes other things the case which in turn screw with the results we want to get when we toggle that variable).

3. *It does not appear to be possible for Schaffer to get the right results in both the conjunction and the disjunction case without significantly revising this formalism.*

   Although Schaffer assumes that his contrastive counterfactual test for grounding applies in the conjunction case, this is not strictly speaking true: since $\mathbf{M}_4$'s directed graph features two direct paths to *Conj*, the test's antecedent is not satisfied.

   One natural response is to take Schaffer to have meant to represent each model not via a *directed graph* but rather via a *directed hypergraph* in which the arrows between vertexes each have a single head but can have multiple tails when a given structural equation links one endogenous variable to several other variables.

   Then we could reinterpret our test as follows:

   > *revised contrastive counterfactual test for grounding*: If there is a direct path to Y that is at least in part from X, and no other distinct path to Y, then: X = x rather than x^* is a token ground of Y = y rather than y^* iff both "If X = x, then Y = y" and "If X = x^*, then Y = y^*" are true.

But then we have a new problem, for it now appears to be the case that the antecedent of our revised principle also applies in the disjunction case, since in that case there is a directed hyperedge from P and Q to *Disj* which corresponds to the structural equation "*Disj* := *max*(P, Q)." However, if we allow that test to apply in the disjunction case, we'll get the wrong result.

Thus it might seem that what we want is for $\mathbf{M}_4$'s graph to feature an arrow from P and Q together to *Conj*, while $\mathbf{M}_5$'s graph features an arrow from P on its own to *Disj* and a separate arrow from Q on its own to *Disj*, so that we can appeal to this difference when selecting which counterfactual test to apply.

But here we face two very difficult problems:

> *first problem*: There is no way to read off this desired difference from the formalism as specified so far, since "*Conj* := *min*(P, Q)" and "*Disj* := *max*(P, Q)" are both functions from P and Q together to the relevant dependent variable.
>
> *second problem*: Although we want *Conj* to depend on P and Q together when all three take the value 1, we want *Conj* to depend on P on its own and also to depend on Q on its own when all three take the value 0. Similarly, although we want *Disj* to depend on P on its own and also to depend Q on its own when all three take the value 1, we want *Disj* to depend on P and Q together when all three take the value 0. But the vertices in our graph are variables, not values of those variables. So it is unclear what kinds of arrows we are even aiming to draw for each graph.

At one point Schaffer claims that one advantage of his formalism is that it can distinguish conjunctive dependence from disjunctive dependence without "needing to take a primitive plural notion of complete ground" (p. 79, n. 32). But I have just argued that his approach does not in fact succeed in differentiating these two things, precisely because it doesn't avail itself of such a notion (nor is it clear how to alter his framework so that some notion of that sort could do the work needed).

IV. Schaffer on the Distinctness of Grounding and Causation

Schaffer is a separatist who endorses

> *the backing model of explanation*: Grounding and causation are not themselves types of explanation, but rather are dependence relations whose instantiations always "back" a corresponding explanation.

Here is the overall package of views he prefers:

- *the causation–grounding comparison*: Causation and grounding are analogous, insofar each can be understood via structural equation models.
- *dependence pluralism*: Causation and grounding are distinct dependence relations (rather than being two species of the same dependence relation, which gets "called 'causation' when it drives the world through time, and 'grounding' when it drives the world up levels" [p. 94]);
- *explanation monism*: There is only one type of explanation that dependence relations such as causation and grounding back (rather than causation backing a distinctive type of "causal explanation" and grounding backing a distinctive type of "metaphysical explanation").
- *dependence and explanation contrastivism*: Causation, grounding, and explanation are contrastive (and all other dependence relations are as well).

Schaffer argues for explanation monism via an argument that is close to my Argument from Transitive Links for grounding monism.

Suppose <u>a gas's mean molecular motions at t_0</u> cause <u>its mean molecular motions at t_1</u>, which in turn ground <u>its heat at t_1</u>.

It is very plausible that <u>the gas's mean molecular motions at t_0</u> explain (in some sense) <u>its heat at t_1</u>.

Two reasons why we shouldn't take 'explains' here to pick out *a hybrid form of explanation* that is distinct from both *the sort of explanation that causation backs* and *the sort of explanation that grounding backs*:

1. "this sort of move will lead to a kind of explosion of types of explanation" (p. 90);
2. "these [various] sorts of explanation are going to be deeply unified" (ibid.).

However, I find it baffling why Schaffer thinks his appeal to hybrid explanations can motivate going one way on the monism vs. pluralism issue with regard to *explanation* but a different way with regard to *dependence*.

> It is just as plausible that the gas's heat at t_1 (in some sense) *depends on* its mean molecular motions at t_0 as it is that the gas's heat at t_1 (in some sense) *is explained by* its mean molecular motions at t_0.
>
> Schaffer takes the relevant dependence relation to involve "a combination of causal, metaphysical, and mathematical factors," so presumably he has in mind the transitive closure of the disjunction of causation and grounding.
>
> But if that combo relation counts as a genuine dependence relation that doesn't lead to an explosion of types of dependence, why can't we make an exactly parallel move when it comes to explanation?
>
> Thus Schaffer's argument against explanation pluralism seems to be undercut by his position on the dependence side of things.
>
> (And, conversely, Schaffer's argument against dependence monism seems to undercut the view he espouses on the explanation of side of things, insofar as the three reasons he provides for distinguishing *causation* from *grounding* seem to work equally well as reasons to distinguish *the sort of explanation that causation backs* from *the sort of explanation that grounding backs*.)

Schaffer's three reasons for distinguishing causation from grounding:

- *first reason*: ". . . grounding implies an associated (metaphysical) supervenience, causation does not imply an associated (nomological) supervenience. This is because there can be indeterministic causation but not indeterministic grounding" (p. 94).

  > (But see Bader's "The Fundamental and the Brute" for an account of indeterministic [or "stochastic"] grounding, although Bader's proposal directly rests on the metaphysical-force-vector model of grounding that we have called into question.)

- *second reason*: ". . . causation connects distinct events but grounding connects indistinct entities. Causation is thus an external relation while grounding is an internal relation. Indeed grounding is what Bennett . . . calls a *super-internal* relation" (pp. 94-95).

  > (Perhaps. But distinctness here is being defined partially in terms of grounding [recall that, for Schaffer, *to be distinct* is *to be neither identical nor connected by ground*], so the relevance of the first point is questionable. And it's much less clear that the relation between (i) *a complete collection of causes together with the natural laws* and (ii) *the effect brought about* is an external relation—cases of indeterministic causation aside.)

- *third reason*: ". . . grounding needs to be well-founded, causation does not. Grounding must be well-founded because a grounding entity inherits its reality from its grounds, and where there is inheritance there must be a [final] source" (pp. 94-95, with needed word added).

  > (But *inheritance* [and *transference*] is the wrong model: when I inherit X from you [or when you transfer X to me], I now have X and you do not. So a better model is *transmittance*. But why think there is such a thing as "reality juice" that gets transmitted from grounds to grounded? And why think each chain of transmittance must ultimately bottom out in an untransmitted transmitter that acts at the ultimate source of reality juice?)