Indeterminacy in Causation

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Abstract: I argue that there are some causal relata for which it is indeterminate whether one caused the other. Positing indeterminacy in causation helps us defend contested principles in the logic of causation and makes possible new ways of thinking about the theoretical impact of symmetric causal overdetermination. I close by discussing amendments of current theories of causation that would help explain causal indeterminacy.

Philosophers often assume that the actual facts provide determinate answers to all the causal questions we might have. I argue here that this assumption is not only unwarranted but false. Section 1 offers examples of causal structures that give us reason to posit indeterminacy in the causal facts. According to the right diagnoses of these cases, I argue, there are some causal relata for which it is indeterminate whether one caused the other. The consequences of positing indeterminacy in causation are wide-ranging and important. In section 2, I argue that indeterminacy in causation helps us see why a contested principle governing the addition of causes is in fact valid. In section 3, I use indeterminacy in causation to defend a principle that governs the distributivity of causes, drawing on parallels between indeterminacy in causation and indeterminacy in counterfactuals to construct one kind of theory that can predict indeterminacy in causation. Section 4 develops the view that symmetric causal overdetermination gives rise to indeterminacy in causation, and draws out some respects in which this view is helpful for ethics and for advocates of non-reductive ontologies. I close

by discussing some ways in which current non-counterfactual theories of causation could be amended to countenance indeterminacy in causation.

1. The Phenomenon

The following case illustrates some features of causal indeterminacy.

THE LONELY SUPERSTARS: Last year, Al played on the Angels, and Betty played on the Brewers. Neither of their teams won the championship; a third team—the Cardinals—did instead. But things could have been different. Indeed, things very nearly were different: Al very nearly decided to play for the Brewers, and Betty very nearly decided to play for the Angels. Neither would ever play for the Cardinals. So if they'd been teammates, they might have played for the Angels, and they might have played for the Brewers. And if they had been teammates, whether they both played for the Angels or both played for the Brewers, the team they both played on would have won the championship.

In the case as described, Al and Betty's playing on different teams was causally relevant to the fact that the Cardinals won the championship.[1] Their playing on different teams was also causally relevant to the fact that both the Angels and the Brewers lost: if Al and Betty had been teammates, one of those teams would not have lost.

It's not so obvious how we should answer two further questions:

1. Was Al and Betty's playing on different teams causally relevant to the Angels' loss?
2. Was Al and Betty's playing on different teams causally relevant to the Brewers' loss?

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[1] I use 'causal relevance' for the "broad and nondiscriminatory" causal relation (Lewis 1973a: 559) that is the target of most metaphysicians' theories of causation. For stylistic reasons I sometimes also use other terms (like 'cause' and 'causal dependence') to refer to this relation or to its inverse.

Answering both questions 'no' looks wrong. Suppose we were trying to give a causal explanation for the Angels' loss. We would likely cite Betty's decision to play for the Brewers as potentially causally relevant. Similarly, we would likely cite Al's decision to play for the Angels as potentially causally relevant to the Brewers' loss. Al and Betty's playing on different teams made a big difference to the outcome for either the Angels or the Brewers. But we should not answer both questions 'yes,' either. Al and Betty's playing on different teams made a difference to the outcome for only one of the teams—the one that would have won if they had played on the same team. So, for example, it is counterintuitive to say that their playing on different teams was causally relevant to the Angels' loss, because even if Al and Betty had played on the same team, it's possible the Angels would have lost regardless. Similarly for the Brewers: it's possible that they would have lost even if Al and Betty hadn't played on different teams. To be sure, we don't have a basis for saying which team would have won the championship, if Al and Betty had played on the same team. But it would be a mistake to count their playing on different teams as causally relevant to both teams' losses. Only one outcome could have been affected by their playing on the same team.

A much more attractive option is to say that it is *indeterminate* whether Al and Betty's playing on different teams is causally relevant to the fact that the Angels lost, and *also indeterminate* whether their playing on different teams is causally relevant to the fact that the Brewers lost. The actual facts do not settle all of our causal questions in this case, because those facts do not make their playing on different teams causally relevant to *both* the Angels' loss and the Brewers' loss, and also do not make their playing on different teams causally relevant to *neither* the Angels' loss nor the Brewers' loss. All this notwithstanding, Al and Betty's playing on different teams is causally relevant to the fact that the Angels and the Brewers both lost the championship, because if they'd played on the same team, the Angels or the Brewers would have won.

While THE LONELY SUPERSTARS suggests that it can be indeterminate what caused what when the causal relata are facts, one might wonder whether causal indeterminacy can occur with other causal relata. On this way of thinking, apparent causal indeterminacy is at least in part due to the causal

relata, and facts allow for a kind of indeterminacy excluded by particulars like events and agents.[2] But adding details to THE LONELY SUPERSTARS helps show that this isn't the case. Suppose that Al and Betty had an argument that was causally relevant to their decision to play on different teams. In particular, suppose that the argument—an event, not a fact—caused Al to play on the Angels, and caused Betty to play on the Brewers. Then, on my view, it is indeterminate whether the argument was causally relevant to the Angels' loss, and indeterminate whether the argument was causally relevant to the Brewers' loss, for reasons analogous to those discussed earlier. Suppose further that Carl—an agent, not an event or fact—provoked the argument. Then it is indeterminate whether Carl was causally relevant to the Angels' loss, and indeterminate whether he was causally relevant to the Brewers' loss. So causal indeterminacy looks to be independent of our views about the causal relata.

Is the kind of indeterminacy at play in THE LONELY SUPERSTARS and these variations on it metaphysical, semantic, or epistemic? If it is epistemic, then our ignorance alone explains why we are reluctant to say either that Al and Betty's playing on different teams is causally relevant to the Brewers' loss, or that it is not causally relevant to their loss. On such views there must be some determinate fact of which we are ignorant: it must be either determinately true or determinately false that Al and Betty's playing on different teams is causally relevant to the Brewers' loss. To sustain this line one needs a very strong non-reductive view on causation, according to which brute causal structure makes it the case that the Angels, say, were determinately causally unaffected by Al and Betty's playing on different teams.[3] Since we can freely add details while preserving the symmetry between Al and Betty's causal contributions, such views would even have to hold that the causal facts do not supervene on the non-causal facts.[4]

Without arguing against anti-reductionism here, I proceed on the assumption that the indeterminacy in question is metaphysical, semantic, or some combination of the two. (I take this assumption to be extremely plausible, but even committed anti-reductionists should be interested in seeing how the dialectic proceeds *given* the assumption.) If we think of this kind of indeterminacy as

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[2] Thanks to an anonymous referee for pressing this point.

[3] Alternatively, one could posit brute counterfactual facts or structure (as in Hawthorne 2005: 404-5), and hold that it is the supervenience base for the causal structure. I won't argue against anti-reductionist theories of counterfactuals here. (Thanks to an anonymous referee for discussion.)

[4] For causal anti-reductionist views and arguments, see Armstrong 1983; Tooley 1987; Woodward 1990; and Carroll 1994; for discussion see Carroll 2009 and Hall 2006 & 2013: 67-9.

metaphysical, then we will say that in cases like THE LONELY SUPERSTARS, for some c and e there is no fact of the matter about whether c caused e. If we think of indeterminacy in the 'causal' facts as semantic, then we will say that there are multiple precise relations that 'cause' and related locutions could denote, given the facts about how denotations are fixed. For one set of such relations, R_1, Al and Betty's playing on different teams bears a relation in R_1 to the Angels' loss, and not to the Brewers' loss. For another set, R_2, Al and Betty's playing on different teams bears a relation in R_2 to the Brewers' loss, and not to the Angels' loss. Inclinations to think about causation in a more or less robustly realist way might incline a theorist toward positing metaphysical or semantic indeterminacy. But the upshot for the metaphysics of causation is significant either way, for according to both posits there is no relation that is distinctively eligible to be the referent of 'causation.'

Both kinds of indeterminacy can be modeled in ways that allow for 'precisifications' or 'resolutions' of indeterminacy, subject constraints imposed by penumbral connections (Fine 1975). In the metaphysical case, we can think of these precisifications as neither 'determinately correct' nor 'determinately incorrect' ways of representing how things are (Barnes & Williams 2011: 115). In the semantic case, we can think of these precisifications as providing denotations for 'cause' that are, again, consistent with the facts about how denotations are fixed (van Fraassen 1966; Fine 1975; Keefe 2000). Either way there will be constraints on how things stand according to the precisifications. For example, according to the precisifications on which 'Al and Betty's playing on different teams caused the Angels' loss' is true, 'Al and Betty's playing on different teams caused the Brewers' loss' comes out false. This is because 'Al and Betty's playing on different teams caused at most one team's loss' is determinately true, and so true according to every precisification. These constraints on precisifications are important in part because they make available subtle, easily overlooked positions on the logic of causation, to which I now turn.

2. Causal Additivity

Carolina Sartorio (2006) argues against the following principle:

Causal Additivity: If c caused e_1, and c caused e_2, then c caused $e_1 \wedge e_2$.

(Although similar principles can be articulated for other categories of causal relata, for simplicity I suppose henceforth that the causal relata are conjoinable and disjoinable facts and that there is causation by omission (following Sartorio among many others, and *pace* Aronson 1971, Dowe 2000, and Beebee 2004).) Sartorio offers the following case as a counterexample to Causal Additivity:

> BATTLEFIELD: I am at the battlefield and I see that some of our soldiers are about to be
> slaughtered by the enemy. I could save any one of them, but only one of them (I only
> have one bullet left). I cannot get myself to choose which one to save so they all die.
> (2006: 374)

On Sartorio's view, for each soldier, the fact that I did not shoot is causally relevant to the fact that that soldier died, because I could have saved any one of the soldiers. But if we read 'all of those deaths' collectively—not distributively—then my not shooting is not causally relevant to *all* of those soldiers' dying: 'although I caused each of the deaths, I didn't cause their sum' (374). This is because *some* soldiers would have died whatever I did; the fact that *some* die is causally independent of me.

I agree with Sartorio's judgment that I am not responsible for the soldiers' dying construed collectively. But I think we do better to say that, for each soldier, it is *indeterminate* whether I am causally relevant to the fact that that solider died.[5] Suppose that the family and friends of one soldier said that I was causally responsible for the fact that that soldier died. I would be within my rights to contrast the situation I was in—one where I could not possibly save more than one soldier—with a situation in which there was only one soldier I could have saved, and for some reason I failed to act. In the latter situation, I am determinately causally relevant to the fact that the soldier died. In Sartorio's situation, I am not, since I can save at most one of the many soldiers.

This diagnosis also makes Sartorio's example consistent with Causal Additivity. On my view, it is indeterminate whether c caused e_1, indeterminate whether c caused e_2, ... , and indeterminate whether c caused e_n. But it is determinately false that c caused e_1, e_2, ... , and e_n. Even though for each

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[5] Sara Bernstein argues independently for a similar conclusion in her forthcoming, focusing on omissions and causal proportionality as sources of causal indeterminacy.

event $e_1, e_2, \ldots, e_n$, there is some precisification according to which c caused that event, there is no precisification according to which c caused *all* the events $e_1, e_2, \ldots, e_n$. So although the antecedent of a substitution instance of Causal Additivity is indeterminate, and the consequent false, there is no precisification according to which the antecedent is true and the consequent false. Sartorio's case is thus not a counterexample to Causal Additivity.

Sartorio later argues that '[i]t is a good thing that Additivity fails when it does' (380) on the grounds that if Additivity did not fail, each one of us would be causally relevant not only to 'the individual deaths of people in distant places' *but also* to 'all those deaths taken collectively' (384). But on my view, again, what I do is not determinately causally relevant to the fact that any particular distant person dies, because I could not possibly save the collective consisting of all the people who would be saved if I were to intervene. Rather, for each of those distant people, it is indeterminate whether what I do is causally relevant to the fact that that person dies in the way that they do. And, again, the ways in which what I do is indeterminately causally relevant to those facts do not make me responsible for the all the deaths taken collectively.

Roberta Ballarin argues for another way to save Causal Additivity. On Ballarin's approach, there are disjunctive effects, where 'though an event or fact, *C,* is neither a cause of an effect, *E1,* nor a cause of a distinct effect, *E2,* it is nonetheless a cause of the disjunctive effect (*E1* or *E2*)' (2014: 22). In Sartorio's BATTLEFIELD, Ballarin holds that 'you cause one of the soldiers to die, but no particular soldier is such that you cause his death…. This is causation of a merely disjunctive effect, where a disjunctive effect, but none of its disjuncts, has been caused' (27). Ballarin thus preserves Additivity by not triggering it: if for each soldier, I am determinately not causally relevant to the fact that that soldier dies, then there's no interesting sum of my relevant causal responsibilities to speak of in the first place.

There are two main components to Ballarin's argument in favor of countenancing disjunctive effects. On the one hand, she is concerned to preserve plausible principles in the logic of causation—Causal Additivity and Causal Distributivity, which I discuss in the next section of this paper. Appealing to indeterminacy in causation gives us another way to preserve those principles. On the other hand, Ballarin draws analogies between causation and the denotations of intensional transitive

verbs: 'there are essentially disjunctive effects in the same sense in which there are essentially disjunctive objects of believing, wanting, and owing, but not of meeting, kicking, and kissing' (23).[6] But the denotations of intensional transitive verbs have many properties not shared by causation.[7] So it's not clear that we should take Ballarin's analogy very strictly—that is, it's not clear that we should see the analogy as giving us *positive* reasons to countenance disjunctive effects. Perhaps it's better seen as a corrective to the thought that disjunctive effects are 'a new kind of spooky entity, merely disjunctive things' (34). The analogy helps us see that they are no spookier than the 'things we owe' when we owe someone a penny but no particular penny. So construed, Ballarin doesn't offer positive arguments for her view over views like mine. Moreover, Ballarin's account has some counterintuitive consequences. For example, in THE LONELY SUPERSTARS, Ballarin's account would make it determinately false that Al and Betty's playing on different teams was causally relevant to the Angels' loss. So a complete causal explanation of that loss would determinately not include the fact that Al and Betty played on different teams. On my account, by contrast, we can say that a complete causal explanation of the Angels' loss would cite the fact that it's indeterminate whether Al and Betty's playing on different teams was causally relevant to it. With appropriate attention to penumbral connections (Fine 1975), this allows us to avoid contradicting the plausible principle that the conjunction of a complete causal explanation of ϕ and a complete causal explanation of ψ is a complete causal explanation of ϕ ∧ ψ.

3. Causal Distributivity

Ballarin also argues that on 'the classical Lewisian counterfactual account of causation,' in BATTLEFIELD I am 'a cause of the big event that is the sum of all three deaths, without being a cause of any of the component deaths' (32–3). And so, she contends, Lewis's 1973 analysis of causation invalidates

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[6] As a rule semantics for intensional transitive verbs do not appeal to "disjunctive objects," due in part to skepticism about the existence of disjunctive objects (see, e.g. Lewis 1970: 218–9 and Wright 2002: 424). For a detailed application and defense of disjunctive objects, see Akiba 2015.

[7] For discussion of properties of intensional transitive verbs see, e.g. Moltmann 1997.

Causal Distributivity: If c caused e_1 and e_2, then c caused e_1 or c caused e_2.

In a limited sense, however, this is unfair to Lewis, because if we supplement Lewis's analysis of causation with Robert Stalnaker's semantics for counterfactuals (1968; 1980), the resulting total theory predicts indeterminacy in causation in such a way that we validate Causal Distributivity.

To see the relevant contrasts between Lewis's and Stalnaker's theories of counterfactuals, consider Quine's classic Bizet / Verdi counterfactuals (1950: 15):

(1)   If Bizet and Verdi had been compatriots, Bizet might have been Italian.

(2)   If Bizet and Verdi had been compatriots, Verdi might have been French.

Lewis and Stalnaker agree that (1) and (2) are both true. And they also agree that (3) is true.

(3)   If Bizet and Verdi had been compatriots, Bizet would have been Italian or Verdi would have been French.

But they disagree about (4) and (5).

(4)   If Bizet and Verdi had been compatriots, Bizet would have been Italian.

(5)   If Bizet and Verdi had been compatriots, Verdi would have been French.

Lewis holds that they are both false (1973: 80); Stalnaker holds that they are both indeterminate—'neither true nor false'—due to 'indeterminacy in the language … even after all the facts are in' (1980: 101). Lewis's commitment to their falsity is a direct result of the truth of (1) and (2) and his commitment to

Counterfactual Duality: 'If it had been that φ, it might have been that ψ' is true iff 'If it had been that φ, it would have been that ¬ψ' is false (Lewis 1973b: 80–1; other advocates include Bigelow & Pargetter 1990: 103; Bennett 2003: 192; and Hájek 2009).

Given Counterfactual Duality, in other words, the truth of (1) makes (4) false, and the truth of (2) makes (5) false as well. Stalnaker rejects Counterfactual Duality, and endorses principles in the logic of counterfactuals that Lewis has to reject—most importantly for our purposes,

Counterfactual Distributivity: $\phi \,\square\!\!\rightarrow (\psi \lor \chi) \vDash (\phi \,\square\!\!\rightarrow \psi) \lor (\phi \,\square\!\!\rightarrow \chi)$[8]

These different approaches to counterfactuals make all the difference when we consider Lewis's 1973 analysis of causation. On that analysis, causation is the ancestral of the 'causal dependence' relation, where event *e* 'depends causally' on a distinct event *c* iff *c* and *e* occur and if *c* had not occurred, *e* would not have occurred.[9] If we combine this theory with Lewis's theory of counterfactuals—in particular, with Lewis's endorsement of Counterfactual Duality—then we predict, as Ballarin argues, that for no soldier in BATTLEFIELD are my actions causally relevant to the fact that that soldier died, although my actions are relevant to the fact that all the soldiers died. Similarly, in THE LONELY SUPERSTARS we predict that the fact that Al and Betty played on different teams is not causally relevant to the fact that the Angels lost, and also is not causally relevant to the fact that the Brewers lost, although it is causally relevant to the fact that the Angels and Brewers lost, taken collectively. Thus either of these cases would constitute a counterexample to Causal Distributivity.

Lewis's 1973 analysis of causation validates Causal Distributivity, however, if we supplement it with Stalnaker's semantics for counterfactuals, or any other plausible semantics for counterfactuals that validates Counterfactual Distributivity.

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[8] This is axiom 5 in Stalnaker's axiomatization of his logic of counterfactuals, C2 (1968: 48).
[9] For broadly similar approaches see Lyon 1967 and the theory of "dependence" in Hall 2004.

Proof. Suppose that *c* is causally relevant to *d* ∧ *e*. Then by Lewis's 1973 theory of causation, if *c* had been false, *d* ∧ *e* would have been false. So if *c* had been false, *d* would have been false or *e* would have been false. Given Counterfactual Distributivity, it follows that either (i) if *c* had been false, *d* would have been false, or (ii) if *c* had been false, *e* would have been false. And by Lewis's 1973 theory of causation, it follows that either (i) *c* is causally relevant to *d* or (ii) *c* is causally relevant to *e.*

This does not mean that if *c* is causally relevant to *d* ∧ *e* then we have the *truth* of '*c* is causally relevant to *d*' or the *truth* of '*c* is causally relevant to *e*.' What we have, rather, is the truth of their disjunction. The claims may both be indeterminate, but they will be indeterminate in such a way that their disjunction is true (just as it may be indeterminate whether this leaf is green, and true that the leaf is either green or not green).

This approach is similar to Stalnaker's response to an argument that Lewis offers in support of Counterfactual Duality. Lewis asks us to suppose that there was no penny in my pocket, and that I didn't look in my pocket. Then, Lewis says, (6) 'is plainly false' (1973: 80).

(6)   If I had looked, I might have found a penny.

Lewis argues that any semantics for 'might' counterfactuals on which Counterfactual Duality is invalid will predict that (6) is true. Stalnaker captures Lewis's reading of (6) by holding that its 'might' has a 'quasi-epistemic reading,' relative to 'what would be compatible with [my knowledge] if I knew all the relevant facts' (1980: 101). If I knew all the relevant facts, I would say that it *couldn't* be that if I had looked, I would have found a penny—or, equivalently on Stalnaker's approach—that it is false that if I had looked, I (quasi-epistemically) might have found a penny.

Stalnaker's approach does not validate Counterfactual Duality because Stalnaker maintains that 'If there is some indeterminacy in the language, there will still remain some different possibilities, even after all the facts are in, and so [quasi-epistemic] possibility will not collapse into truth.' For example, there is enough indeterminacy in the language that both (4) and (5) are neither true nor false even relative to 'what would be compatible with [my knowledge] if I knew all the relevant facts.'

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This is how Stalnaker manages to 'agree with Lewis's account that *If A, it might be that B* is true if and only if *If A, it would be that not-B* is not true' (101) while denying Counterfactual Duality: some 'would' counterfactuals are neither true nor false although the 'might' counterfactuals that are *prima facie* dual to them are true. If we adopt Stalnaker's semantics for counterfactuals, we can say that the indeterminate (4) and (5) are analogous to the indeterminate (7) and (8):

(4)   If Bizet and Verdi had been compatriots, Bizet would have been Italian.

(5)   If Bizet and Verdi had been compatriots, Verdi would have been French.

(7)   If Al and Betty had been teammates, they would have played for the Angels.

(8)   If Al and Betty had been teammates, they would have played for the Brewers.

This is what allows us to say that it is indeterminate whether Al and Betty's playing for different teams is causally relevant to the fact that the Angels lost, and that it is indeterminate whether Al and Betty's playing for different teams is causally relevant to the fact that the Brewers lost, but that it is *true simpliciter* that Al and Betty's playing for different teams is causally relevant to the fact that the Angels and the Brewers lost.

    At this point Lewis, and many sympathetic with his views on counterfactuals, might argue that Stalnaker's semantics relies on an objectionable principle:

The Limit Assumption: For every possible world *i* and non-empty proposition *A*, there is at least one *A*-world minimally different from *i* (Stalnaker 1980: 89; see also Pollock 1976: 18–20; Herzberger 1979; Lewis 1981: 228; and Warmbrōd 1982).

As Lewis puts his complaint, 'we have no right to assume that there always are a smallest antecedent-permitting sphere and, within it, a set of closest antecedent-worlds' (1973: 20). Fortunately it is possible to reconcile Stalnaker's semantics with failures of the limit assumption, by appealing to ordering supervaluationism, an extension of traditional supervaluationism (Swanson 2012; 2014).

We can thereby secure the validity of Causal Distributivity, given a counterfactual theory of causation.[10]

Ordering supervaluationism subsumes traditional supervaluationism, handling not only cases in which there are multiple 'tied-for-best' precisifications, but also cases in which for each precisification, another is better. Intuitively—and putting the point in terms of semantic indeterminacy for the sake of its familiarity—if as we consider better and better precisifications of a sentence, we eventually come to a boundary within which all the precisifications are true, then we can abstract away from the competition between precisifications, and from the differences between those competing precisifications, and say that the sentence is ordering supertrue. This is not so different from the intuitive thought behind traditional supervaluationism: if a sentence is true on all 'admissible' precisifications, then we can abstract away from the competition between precisifications, and from the differences between those precisifications, and say that the sentence is supertrue (van Fraassen 1966: 486–7; Fine 1975: 278). Stalnaker deploys traditional supervaluationism to handle cases in which multiple antecedent worlds are equally close to the world of evaluation: he sees traditional supervaluationism as a post-semantic mechanism with which we can 'reconcile the determinacy of abstract semantic theory with the indeterminacy of realistic application' (1980: 89). This approach allows Stalnaker to preserve his logic for counterfactuals even when there are multiple equally close antecedent worlds.

Ordering supervaluationism serves exactly the same purpose, but with a broader range of application. We can give Stalnaker's semantics for counterfactuals, and handle violations of the limit assumption (and uniqueness assumption) in the post-semantics, via ordering supervaluationism. When for a given counterfactual there are no antecedent worlds that are *closest* to the world of evaluation, we in effect ask whether, as we consider antecedent worlds that come closer and closer to the world of evaluation, we eventually come to a boundary within which all the antecedent worlds are also consequent worlds. If so, the counterfactual is ordering supertrue. If as we consider antecedent worlds that come closer and closer to the world of evaluation, we eventually come to a

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[10] Theories according to which counterfactual dependence is sufficient for causation will also secure the validity of Causal Distributivity, as long as they connect indeterminacy in counterfactuals to indeterminacy in causation in the appropriate ways.

boundary within which all the antecedent worlds are worlds in which the consequent is false, then the counterfactual is ordering superfalse. Otherwise it is indeterminate. More precisely: the counterfactual is interpreted repeatedly, relative to selection functions that yield worlds that are closer and closer to the world of evaluation. If the selection function associated with precisification a yields a world that is closer to the world of evaluation than the selection function associated with precisification b, then a is a better precisification of the counterfactual than b is. The counterfactual is ordering supertrue iff there is some precisification of the counterfactual, i, such that the counterfactual is true according to all the precisifications that are at least as good as i. It is ordering superfalse iff there is some precisification of the counterfactual, i, such that the counterfactual is false according to all the precisifications at least as good as i. And, again, it is indeterminate otherwise.

What is attractive about this approach is that it not only lets us get Stalnaker's logic for counterfactuals when there are multiple 'tied-for-closest' antecedent worlds—it *also* lets us get Stalnaker's logic when for every antecedent world another is closer (for further discussion, see Swanson 2012). In particular, we get the ordering supervalidity of Counterfactual Distributivity, repeated below.

Counterfactual Distributivity: $\phi \mathbin{\square\!\!\rightarrow} (\psi \lor \chi) \vDash (\phi \mathbin{\square\!\!\rightarrow} \psi) \lor (\phi \mathbin{\square\!\!\rightarrow} \chi)$

Lewis's theory of counterfactuals does not validate Counterfactual Distributivity: if as we consider ϕ worlds that come closer and closer to the world of evaluation, we never reach a boundary within which all the ϕ worlds s are ψ worlds, or all the ϕ worlds are χ worlds, then it may be that $\phi \mathbin{\square\!\!\rightarrow} (\psi \lor \chi)$ even though $\neg(\phi \mathbin{\square\!\!\rightarrow} \psi) \land \neg(\phi \mathbin{\square\!\!\rightarrow} \chi)$. But Stalnaker's theory, supplemented with ordering supervaluationism, would make any given precisification of Counterfactual Distributivity true. Relative to a *particular selection function,* $\phi \mathbin{\square\!\!\rightarrow} (\psi \lor \chi) \vDash (\phi \mathbin{\square\!\!\rightarrow} \psi) \lor (\phi \mathbin{\square\!\!\rightarrow} \chi)$. As a result, any instance of Counterfactual Distributivity is ordering supertrue, and similarly for Causal Distributivity. But of course it is possible that it is neither supertrue nor superfalse that $\phi \mathbin{\square\!\!\rightarrow} \psi$, and neither supertrue nor superfalse that $\phi \mathbin{\square\!\!\rightarrow} \chi$, while it is supertrue that $(\phi \mathbin{\square\!\!\rightarrow} \psi) \lor (\phi \mathbin{\square\!\!\rightarrow} \chi)$. Thus we can use a logic of counterfactuals that validates Counterfactual Distributivity to provide a logic of

causation that validates Causal Distributivity—and use ordering supervaluationism as a post-semantic repair mechanism when we encounter failures of the limit assumption.

It may be helpful also to see how ordering supervaluationism helps in a particular case where the limit assumption fails.

SELECTING A TEAM: Every player who is at least six feet tall is selected for the team. Every player who is less than six feet tall and whose height expressed in inches is a rational number is also selected for the team. Every player who is less than six feet tall and whose height expressed in inches is an irrational number is not selected for the team.

In this example, a player's being at least six feet tall is determinately not causally relevant to her being selected for the team, by Lewis's lights, because on Lewis's semantics for counterfactuals it's determinately false that if that player hadn't been at least six feet tall she wouldn't have been selected for the team. On Stalnaker's semantics, supplemented with ordering supervaluationism, this counterfactual comes out indeterminate: as we interpret the counterfactual relative to selection functions that yield antecedent worlds that are closer and closer to the world of evaluation, we never come to a boundary within which all those antecedent worlds are also worlds in which the consequent is true *or* worlds in which the consequent is false. So the counterfactual is neither ordering supertrue nor ordering superfalse; it is indeterminate. So it's also indeterminate, given Lewis's 1973 analysis of causation, whether the player's being at least six feet tall is causally relevant to her being selected.

Much of this dialectic can be replayed for Lewis's 2000 theory of causation. In cases that demonstrate how this account invalidates Causal Distributivity, c influences $d \wedge e$ without influencing d and without influencing e. We get this structure when, roughly speaking, if there were alterations of c there would have been alterations of $d \wedge e$, but if there were alterations of c there wouldn't necessarily have been alterations of d and there wouldn't necessarily have been alterations of e. On Lewis's theory of counterfactuals, in such cases it will be false that c influences d, and false that c influences e; on Stalnaker's theory both those claims will be indeterminate.

None of this is to say that we must have either Lewis's 1973 theory of causation or his 2000 theory to get the requisite kind of indeterminacy in causation. Rather, it is to illustrate one way in which that indeterminacy can be captured by an important theory of causation, supplemented by a particular theory of counterfactuals. To the extent that we like counterfactual theories of causation in the first place—whether for omissions, for Hall's notion of 'dependence' (2004), with more defense than Lewis offers (Coady 2004), or with elaborations and amendments that Lewis does not offer (Paul 2000)—it's good that they predict indeterminacy in causation. This is not a point *against* other general approaches to theorizing about causation. But as we make amendments and fill in details, within such approaches, to predict indeterminacy in causation, we are aiming to emulate this feature of counterfactual theories.

4.   Symmetric Overdetermination

Jonathan Schaffer presents the following dilemma:

> When c_1 and c_2 are overdetermining causes of e, are c_1 and c_2 each causes of e
> individually, or are c_1 and c_2 only a cause of e collectively? (2003: 24)

Schaffer argues for the first view ('individualism') in part on the grounds that according to the second view ('collectivism') either "(i) c_1 ($/c_2$) individually causes nothing, in which case the power of $c_1 \lor c_2$ is a mysterious emergent power; or …(ii) c_1 ($/c_2$) individually causes part of e, in which case it is hard to understand how c_1 individually can fail to count as a cause of e" (38). Allowing for indeterminacy in causation gives us (as it were) a Third Way: we can say that it is indeterminate whether c_1 is causally relevant to e, and indeterminate whether c_2 is causally relevant to e, but determinately true that $c_1 \lor c_2$ is causally relevant to e. We thus avoid saying that $c_1 \lor c_2$ has emergent causal powers, and also avoid saying that c_1 (or c_2) is a cause of part of e. Schaffer's other arguments for individualism don't generalize to this position. Indeed, I think they suggest that we do significantly

better to posit indeterminacy in symmetric overdetermination cases than to endorse individualism. I'll consider each of Schaffer's arguments in turn.[11]

Schaffer argues that 'individual overdeterminers play the predictive, explanatory, manipulative, and moral roles of causes' (29). My response to Schaffer's argument about the predictive roles of causes is relevant to Schaffer's other arguments, so I begin by laying out that response in depth. If two rocks simultaneously shatter a window, Schaffer writes, 'knowledge that $rock_1$ is thrown at the window (on an accurate trajectory, with enough force) is sufficient to license a prediction that the window will shatter' (29). While that's true, the predictive role of causal thought isn't exhausted by our ability to predict what will happen if an event occurs. We also want to use our knowledge of causal facts to help us predict what would have happened if said event *hadn't* occurred. Knowledge like that helps us learn about how things work, helps us think about responsibility, and helps us make informed choices about how to deal with similar phenomena in the future. In this particular example, the knowledge we should not overlook is that intervening to prevent $rock_1$ from reaching the window would not have prevented the window from shattering. To know this, we need to know more than that it's indeterminate whether $rock_1$ caused the window to shatter. But if we know in addition simply that the fact that $rock_1$ was thrown or $rock_2$ was thrown was causally relevant to the window's shattering, then we know that intervening on just one rock's path would not have been enough to save the window. The underlying problem here is that individualism makes symmetric overdetermination too similar to joint causation. To see this, suppose that another window would not have shattered unless two (other) rocks hit it. Those rocks *are* both determinately causally relevant to the shattering of the window, and intervening to prevent either rock from reach the window *would* have prevented the window from shattering. But if Schaffer were right about individualism, then the joint causation case would have the same causal structure as the symmetric overdetermination case. Countenancing indeterminacy in causation gives us an intuitive way to draw distinctions here that are important to predictive causal reasoning.

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[11] I do not consider Schaffer's arguments from conversational pragmatics here, because discussing the complexities of the interaction between indeterminacy, pragmatics, and the judgments of ordinary speakers would lead us far afield.

Now let us turn to explanation. In some contexts and for some purposes, it will suffice to answer the question 'Why did the window shatter?' by saying 'Because rock$_1$ was thrown at it,' as Schaffer observes (29). But in other contexts, and for other purposes, this explanation is incomplete in problematic ways. If we are trying to prevent or get compensation for window shatterings, for example, it will be important to describe rock$_2$'s causal role. But as before we should avoid giving a description of the rocks' causal roles (individually and collectively) that assimilates the causal structure of symmetric overdetermination to a causal structure associated with joint causation. Countenancing indeterminacy in causation makes that possible. With respect to manipulation, Schaffer observes that 'were c_1 different in any of many ways, then e would have been different in any of many ways' (29). But whether we have a case of symmetric overdetermination or a case of joint causation affects how and to what extent manipulating c_1 affects e.

Finally, countenancing indeterminacy in causation raises fascinating moral questions, only some of which I am able to pursue here. While it's true that, as Schaffer writes, 'an agent who performs c_1 is liable to praise or blame for e' (30; see also Goldman 1999), the nature of the praise or blame is affected by the presence and causal role of the overdetermining cause. I can best make the case for this thesis through examples. First, suppose that we both work hard on our collective project, which turns out to be a success. But either one of us working hard would have sufficed for that success. We both deserve praise, but neither of us, I think, deserves praise in quite the way that we would as the *sole* cause of the success. Second, Iris Marion Young argues that 'Political responsibility in respect to structural injustice … often requires transforming institutions and the tasks they assign. *This is everyone's task and no one's in particular*' (2004: 385, emphasis added). A given institution could be transformed without *everyone's* intervention, and many groups that would suffice to transform such an institution are on a par with each other. So the failure to transform an institution is symmetrically overdetermined by many groups' omissions. To hold every group that would suffice to effect such a transformation as wholly, determinately responsible for the failure to bring about the transformation is inconsistent with ordinary practice, and, I think, inconsistent with our reflective judgments about how to apportion blame. This is part of Young's point, I take it, when she writes that transforming

institutions is the responsibility of no one in particular.[12] Third, Robert Goodin offers a case of a terrorist gang, the members of which have different roles and responsibilities—there is 'the mastermind, the detonator, the decoy, the passive member, etc.' Goodin suggests that 'Lesser degrees of responsibility fall to those … who played what were only very minor roles, in the sense that the basic plot—the overall outcome—would have been little changed if they had been omitted altogether' (1987: 181). Similarly, in symmetric overdetermination cases the fact that the 'overall outcome' would have been *no* different if one of the overdetermining causes had not occurred affects the sense in which the individual overdeterminers are responsible for the outcome. While there are many ways in which indeterminacy in causation might impact moral judgments, countenancing it is an important step toward explaining these moral distinctions.

Schaffer also argues that 'individual overdeterminers and their effects are connected by complete processes' (33), and therefore deserve to count as causes. Countenancing indeterminacy in causation changes the dialectic here quite a bit. We might say, for example, that indeterminacy in causation can arise when it's indeterminate whether a process is complete. In cases of symmetric overdetermination, this indeterminacy would arise if it were not possible for both the process associated with $rock_1$ and the process associated with $rock_2$ to be complete with respect to the shattering of the window. In light of this possibility, we are not yet in a good position to say to what extent the connection between symmetric overdeterminers and their effects resembles the connection between ordinary causes and their effects. Before working on that question, we need to work out the best way to reconcile process views on causation with indeterminacy in causation.

Jonathan Livengood (2013) offers further reasons to reject individualism, although his arguments don't distinguish straightforwardly between collectivism and countenancing indeterminacy. Livengood shows that several recent characterizations of 'singular' or 'actual' causation in terms of structural equations[13] count every abstention as a cause of the winner's victory in simple-majority elections, and count every vote as a case of the victory in all simple-plurality elections with more than two candidates—however the votes were distributed. Individualism is the

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[12] See also Sara Bernstein's discussion of charity cases in her forthcoming.
[13] In particular: Hitchcock 2001; Woodward 2003; Halpern & Pearl 2005; and Hall 2007.

culprit. These characterizations and others like them should be revised to allow for indeterminacy, thereby avoiding wholesale collectivism and the danger of making *no* abstentions count as causes.[14] But I want to caution against the temptation to think of votes in cases of overdetermination as 'instances of a weak species of causation, call it *partial* causation, or *contributory* causation, or causal *influence*' (Goldman 1999: 206). Overdeterminers don't 'weakly' or 'partially' cause an effect: to say that is again to assimilate symmetric overdetermination to joint causation. Rather, the causal facts simply don't settle questions about *which* overdeterminer caused the effect.

Treating symmetric overdetermination in the way that I have developed here opens up an interesting possible response to Laurie Paul's worry that 'nonreductionism generates massive amounts of symmetric causal overdetermination' (2007: 278; see also the discussion in Hall & Paul 2013: 155–61). The counter-intuitive nature of pervasive symmetric overdetermination leads Paul to argue that non-reductionists should hold that macro- and micro-level objects can share property instances, and that, given a theory of property instance causation like the one she develops in her 2000, 'causal responsibility is shared, not overdetermined' (85). Paul's response, and that of some others who have worked on this problem (e.g. Wilson 2011), is in effect to argue that we should endorse a package of views that does not lead to symmetric causal overdetermination. Such packages, elegant as they are, aren't forced on the non-reductionist who countenances causal indeterminacy. She may say instead that for each 'level' or 'layer' it is indeterminate whether facts at that level caused a given effect, but that it is determinately true that the sum of layers caused the effect.

5. Accounting for Indeterminacy in Causation

There is much work to be done in amending various theories of causation to account for causal indeterminacy. Here are a couple of examples. Suppose we have a regularity theory of causation according to which *c* causes *e* iff *c* and *e* are facets of an appropriate pattern of succession. On such a

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[14] Such revisions might also help these approaches avoid a "modal cost" that Livengood notes: "Instead of attending to counterfactual dependence only in the actual circumstances, the individualist must attend to counterfactual dependence in counterfactual circumstances as well" (324).

view, what would it be for it to be indeterminate whether *c* causes *e*? Presumably it would have to be indeterminate whether *c* and *e* are facets of an appropriate pattern of succession. Such indeterminacy might come from any of several different sources. For example, it might be determinate what the appropriate patterns of succession are, but indeterminate whether *c* and *e* are facets of one. It might be determinate that *c* and *e* are facets of a pattern of succession, but indeterminate whether the pattern is appropriate. It might be determinate that *c* and *e* are facets of something, but indeterminate whether the thing they are facets of is a pattern of succession (though if it is a pattern of succession, say, it is an appropriate one). While this is just a toy example of a regularity theory, it should be enough to make it clear that extending regularity theories to accommodate the cases discussed here isn't a trivial matter: at a minimum, there are many choice points for the regularity theorist. Here is another example. Suppose we have a process theory of causation according to which *c* and *e* are part of a causal process iff they are part of 'a world line of an object that possesses a conserved quantity' (Dowe 1995: 323). What would it be for it to be indeterminate whether *c* and *e* are part of a causal process? Again, indeterminacy could in principle creep in at several points: it may be indeterminate whether *c* and *e* are part of a world line of an object, indeterminate whether the world line possesses a certain quantity, indeterminate whether the quantity is conserved, and so on. Finally, we could enhance structural equation models by using supervaluations (Schaffer 2016), fuzzy sets (Palumbo, Romano, & Vinzi 2008), or some other approach to represent indeterminacy. Halpern and Hitchcock 2010 and 2013 discuss some other possible sources of indeterminacy in structural equation models. It is interesting to ask whether one representation of the relevant indeterminacies would suffice and, if not, how multiple representations of indeterminacy would interact.

One reason why there is so much work to be done here is that it's not indeterminacy *per se* that matters. Rather, we should aim to capture the logical relationships that allow indeterminacy in causation to do the work I've outlined here, validating principles like Causal Additivity and Causal Distributivity, and handling considered judgments about symmetric overdetermination in an elegant way. One way to explain this is to analyze causation in terms of counterfactuals, and to adopt a Stalnakerian semantics for counterfactuals. Whether or not we should use counterfactuals in

analyzing causation, the correlations between indeterminacy in counterfactuals and indeterminacy in causation are striking. Theories of causation should aim to predict and explain them, and, as I've suggested, philosophers in general should aim to exploit them.[15]

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