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RESEARCH ARTICLE

Casting a Shadow on Lewis's Theory of Causation

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Abstract: First I present a puzzle involving two opaque objects and a shadow cast on the ground. After I offer a solution to this puzzle by identifying which of the objects is causally responsible for the shadow, I argue that this case poses a counterexample to David Lewis's latest counterfactual account of causation, known as his influence theory. Along the way, I discuss preemption, overdetermination, absence causation, and trumping preemption.

Keywords: Absence causation; counterfactual theory of causation; influence theory of causation; overdetermination; preemptive prevention; trumping pre-emption.

1.

Here is a puzzle: In the below cross-sectional diagram, L is a very distant light source (like the sun), A and B are two opaque rectangular objects with equal widths but different heights. (We can take the thicknesses of A and B as negligible.) The light ray coming from L grazes the upper right edges of A and B. If only A had been present, it would have cast the shadow $R+S$ on the ground; and if only B had been present, it would have cast the

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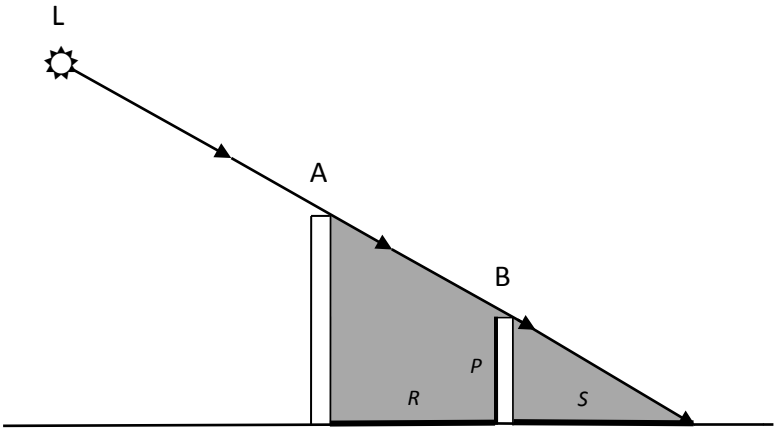

shadow *S*. In the situation above, *P* is the shadow A casts on B (which coincides with the area of B facing A).

Question: Clearly, the shadows *R* and *P* are caused by A. But which one of A and B is causally responsible for the shadow *S*?

(1) B cannot be causing *S*, because B is not receiving any light, as A completely blocks all the light from reaching B. And an object which does not have any light impinging on it cannot cast any shadow.

(2) A cannot be causing *S*, because A's casting *S* is prevented by A's casting *P* on B. An object can cast only one shadow in the presence of one light source. In this case, A's full shadow due to L is *R*+*P*; so we cannot claim that A casts *S in addition to* casting *P*.

(3) Since neither A nor B is causally responsible for *S*, we cannot say A and B overdetermine *S*. For in overdetermination situations, there are two or more causes each of which produces the very same effect independently of the others. Nor can we say that there is preemption here—that one of A and B is preempting the other and is itself causing *S*—for neither is a cause of *S*.

Then *what* is causing *S*?

2.

My answer to this puzzle is that it is A, despite the considerations in (2). Clearly, A is what is causing the dark region (umbra) to the right of A, by blocking the light coming from L. (B has no share in bringing about that dark region, as B does not receive any light.) The presence of the ground (represented by the long horizontal line in the figure) that intersects with the dark region leads to the formation of the shadow $R+S$ on the ground. Hence, it is A that is causally responsible for S. Thus we need to give up the principle we mentioned in (2), that an object can cast only one shadow in the presence of one light source.

B is a "back-up cause" of S: If A had not been present, B would have cast S. It follows that we do have a case of preemption here, after all: A preempts B from causing S. B cannot be said to be an overdetermining cause of S together with A. For to claim that A and B are overdetermining causes of S would be to imply that *both* A and B can be credited for causing S independently of the other. But B can be given no such credit, as A blocks all the light from reaching B. The causal pathway from B to S, which would have existed had A not been present there, is thwarted by the presence of A.

3.

I asserted above that the presence of A is the cause of the formation of S and that the presence of B is merely a potential cause of it which is preempted by A. In making that assertion I assumed the following description of the effect-event:

e_{fs}: formation of the shadow S.

But one might choose to describe the effect-event as follows, instead:

e_{pl}: prevention of light from reaching the surface S.

With the second description e_{pl}, the situation in the diagram becomes a case of "redundant prevention" or "preemptive prevention": B's prevention of light from entering S's region was preempted, or was redundant, because of the presence of A. Let us now ask if our causal judgments above will be

different if we view the situation as a case of redundant or preemptive prevention.

Let us take a closer look at the notion of redundant prevention using the following example of a redundant prevention Michael McDermott gives:

> Suppose that I reach out and catch a passing cricket ball. The next thing along in the ball's direction of motion was a solid brick wall. Beyond that was a window. Did my action prevent the ball hitting the window? (Did it cause the ball to not hit the window?) Nearly everyone's initial intuition is, "No, because it wouldn't have hit the window irrespective of whether you had acted or not." To this I say, "If the wall had not been there, and I had not acted, the ball would have hit the window. So between us—me and the wall—we prevented the ball hitting the window. Which one of us prevented the ball hitting the window—me or the wall (or both together)?" And nearly everyone then retracts his initial intuition and says, "Well, it must have been your action that did it—the wall clearly contributed nothing." (McDermott 1995, 525)

McDermott himself endorses the revised judgment of the majority that he reports.

Nevertheless, I do not share the intuitions of McDermott (and of "nearly everyone" he asked) in the ball catching example. Stopping of the ball before reaching the wall cannot be said to have prevented the window's breaking, since the window was not in any real danger of being broken anyway, thanks to the presence of the solid wall. Imagine, if you like, that in front of the window was a huge military tank, rather than the brick wall, situated to protect the window from breaking. Then the ball catcher can hardly be given credit for preventing the window from breaking by the ball.[1]

John Collins gives a similar example of preemptive prevention:

> As the ball flew toward us, I leapt to my left to catch it. But it was you, reacting more rapidly than I, who caught the ball just

[1] If, instead of the ball, an ultra-piercing bullet was fired towards the window, which could penetrate the tank and shatter the window, and our catcher stopped *that*, then he would have done some real preventing.

> in front of the point at which my hand was poised. Fortunate for us that you made the catch. The ball was headed on a course that, unimpeded, would have taken it through the glass window of a nearby building. Your catch prevented the window from being broken.
>
> Or did it? Had you not made the catch, I would have caught the ball instead. My leaping to catch the ball made your catch redundant. Given my presence, the ball was never going to hit the window. (Collins 2000, 223)

Collins disagrees (as I do) with McDermott's judgment in McDermott's example, but thinks that his own example is different. In his example, the person who caught the ball did prevent the window's breaking:

> If neither of us had reached for the ball, then the ball would have hit the window. So between us—you and me—we prevented the ball from hitting the window. Which one of us prevented the ball from hitting the window—you or I (or both of us together)? Well, clearly it must have been you, for it was you and not I who made the catch. I contributed nothing. (Collins 2000, 223-224)

According to Collins, in McDermott's example, "The presence of the wall really does seem to make your catch irrelevant." (Collins 2000, 224)

Both McDermott and Collins think that, in their own respective examples, the ball catcher is the preventer of the window's breaking. (McDermott: "it must have been your action that did it—the wall clearly contributed nothing"; Collins "it was you and not I who made the catch. I contributed nothing.") Be that as it may, I think our shadow case is somewhat different from the two authors' examples. A more closely analogous scenario to our shadow case would be if there were two parallel solid walls, each sufficient, by itself, to stop the ball from reaching the window. The ball hits one of the walls, call it wall_{A}, and is stopped by it; and the other wall, call it wall_{B}, contributes nothing. On this analogy, wall_{A} is clearly what did the preventing of the window's breaking, just as the opaque object A prevented the surface *S*'s getting lit; while wall_{B} is a backup preventer of the window's breaking, just as object B is a backup preventer of the surface *S*'s getting lit. What is important from my point of view is that, whether we regard our shadow scenario as a case of

preemptive prevention—taking e_{pl} as the effect-event—or as an ordinary causation of the emergence of the shadow S—taking e_{fs} as the effect-event—our judgments about what is causally responsible for the effect in question do not change.

4.

There is no general agreement, however, that cases of prevention and preemptive prevention, like the unbroken window examples above, are cases of causation. The so-called cases of "negative causation" or "absence causation"—such as preventions, omissions, lacks and the like—are puzzling for theories of causation. There are philosophers taking opposing sides on the issue of whether absence causation should be regarded as genuine causation or should be treated as pseudo or "quasi" causation.[2] Some philosophers of causation are inclined to take at least some cases of prevention and omission as legitimate cases of causation, and the challenge for them is to pin down what distinguishes such cases from those absences which should not count as instances of causation. Ordinary intuitions also tend to take some absences as causal and some others not so. For example, when we say, "The driver's failing to see the warning sign on the road caused this fatal traffic accident," we seem to be attributing the cause to an absence: the driver's not noticing the sign. And when we say, "This fatal traffic accident caused him not to make it to the party," we seem to be referring to an absence as the effect, i.e. him not making it to the party. Sometimes both the cause and the effect are taken to be negative events as in, "Lack of sufficient lighting on the road caused the driver to miss the road sign." In still other examples of absences, the alleged cause and the alleged effect fail to compose a causal claim: "Nobody's dropping a bomb on the North Korean leader caused him not to die."

There are well known problems with taking absences as causes or effects, one of which is that it allows too many things to be causes or effects. For

[2] See, for example, the debate between Dowe and Schaffer (Dowe 2004; Schaffer 2004). It is not my purpose in this paper to take a position on the *general* issue of whether absences have causal efficacy or not.

example, my not walking on the surface of the planet Mercury right now is a cause of my writing this paper right now (if I were walking on the surface of Mercury at this moment, I couldn't be writing this paper). And my writing this paper right now is a cause of my not being on vacation in Hong Kong (or any other city) right now.

Now, it seems plausible to think of a shadow as absence of (some amount of) light from a surface. Thus our shadow set-up in the diagram can be viewed as involving a case of prevention—prevention of light from striking the relevant surface. Those philosophers who think that (at least some) preventions are not cases of causation would demand a justification for why A's prevention of light from reaching *S*'s surface should be described as A's *causing S*, which is how I described it above. Let me first point out a difference between our shadow case and the typical cases of prevention such as the ones in McDermott's and Collins's examples above. When the ball headed straight towards the window was caught before it reached the window, there occurred no change in the window's physical appearance or properties: it was unbroken *before* the ball was caught and remained unbroken *after* the ball was caught. Not so in our shadow example. For one thing, when A (and B) were put there and the shadow *S* was formed due to the blockage of light by A, the area occupied by *S* on the ground started to become cooler, due to the photons being prevented to transfer energy to that area. So, there did occur a change in the world in the vicinity of *S* in terms of temperature drop on *S*'s region compared to its surroundings. Moreover, when light was prevented by A, the contour lines of *S*, which were not there before A (and B) were placed there, emerged on the ground. There were other changes too, of course, brought about by the presence of *S* on the ground, such as the darkness observed on the ground by an observer standing near *S*.

There were no such changes in the window whose breaking was prevented by the successful catch of the ball. This is the big difference between our scenario and typical prevention and other absence cases: prevention of light by A has observable impacts on the world. Hence someone who thinks that preventions are not causes because they do not create relevant kinds of changes in the world, need not view shadows as "passive preventions" in the same way. My view is that shadows have *causes*; they are caused by

light blockers and the presence of a ground, screen or something of that sort on which the shadow is projected. (Without something for a shadow to project itself on, we only have an umbra, which is not a shadow but a dark region in space.) And shadows certainly produce *effects* which are all too familiar: you can cool off on a hot day in the shadow of a tree, you can take a photo of a shadow, some shadows can be scary or funny, solar and lunar eclipses are exciting for us, etc.[3]

But, if someone were to insist that causal talk involving shadows is objectionable on the grounds that it involves absence causation, let me point out that we could pose the puzzle of section 1 without talking about shadows at all. In this way we can turn our scenario into one involving "presence causation" instead of absence causation. For example, instead of taking as our effect the emergence of shadow *S*, we could take it to be the presence of the event of cooling of the region *S*.[4] In that case our puzzle becomes: *What is causing the temperature drop* in region *S*—A or B? My answer would be the same as before: A is causing it and B is a preempted backup cause of it.

5.

Another interesting feature of the situation in the shadow diagram is that it seems to pose a problem for David Lewis's well-known counterfactual analysis of causation (Lewis 1973). Although, as I argued, the presence of A is causally responsible for the shadow *S*, we do not have a series of actual events running from A to *S* that constitute a chain of counterfactually

[3] Roy Sorensen is another author who thinks "shadow" is a causal concept, i.e. shadows are both caused by and cause things. See (Sorensen 2008, 9, 12, 18, 192).

[4] This strategy is similar to a strategy of replacing absences with presences described by Schaffer: "given that the gardener napped and my flowers wilted, 'The gardener's not watering my flowers caused my flowers not to blossom', is to be interpreted as: the gardener's napping rather than watering my flowers caused my flowers to wilt rather than blossom" (Schaffer 2005, 301). So, we can restate our claim regarding the shadow case as: Light's being blocked by A caused the cooling of the surface *S*.

dependent events from A to *S*, which Lewis's analysis requires. The presence of B blocks completion of such a chain. Take, for example, the events:

d_1: the presence of the dark region between A and B

d_2: the presence of the dark region to the right of B,

and consider the counterfactuals:

If A had not been present, then d_1 would not have occurred

If d_1 had not occurred, then d_2 would not have occurred

If d_2 had not occurred, then *S* would not have formed.

These counterfactuals fail to yield a chain of counterfactually dependent events in Lewis's sense, because the second counterfactual is false: even if d_1 had not occurred, d_2 would still have occurred thanks to the presence of B.[5]

Hence the situation in the diagram poses a counterexample to Lewis's 1973 analysis of causation. And this case does not seem assimilable to the other problematic cases for that analysis, which Lewis tried to deal with by emending his original 1973 account in his 1986 "Postscript to 'Causation'" (Lewis 1986). Lewis's dissatisfaction with some of his emendations in that "Postscript" led him to offer a new counterfactual theory in 2000 (Lewis 2000). This improved theory accounts for causation in terms of the notion of influence, which is defined by Lewis as follows:

> Where *C* and *E* are distinct actual events, let us say that *C influences E* if and only if there is a substantial range C_1, C_2 … of different not-too-distant alterations of *C* (including the actual alteration of *C*) and there is a range E_1, E_2 … of alterations of *E*, at least some of which differ, such that if C_1 had occurred, E_1 would have occurred, and if C_2 had occurred, E_2 would have occurred, and so on. (Lewis 2000, 190)

[5] The falsehood of the second counterfactual also follows from Lewis's possible-world semantics for counterfactuals: some world where d_1 does not occur and d_2 does is closer to the actual world than any world where both d_1 and d_2 fail to occur.

An event C, then, is a cause of an event E if and only if C influences E, or there is an ancestral of influence from C to E.

As an illustration of how the influence theory works, let us look at an example of how this theory is supposed to take care of trumping preemption cases, which are among the most challenging cases of causation to deal with by a counterfactual approach. An example of trumping preemption was given by Jonathan Schaffer:

> Imagine that … the major and the sergeant stand before the corporal, both shout "Charge!" at the same time, and the corporal decides to charge.[…] Orders from higher-ranking soldiers trump those of lower rank. I hope you agree that the major's order, and not the sergeant's, causes the corporal's decision to charge …. (Schaffer 2000, 175)

Lewis thinks that his improved theory can handle Schaffer's example. According to the new criteria Lewis added, first we imagine altering the trumping event while keeping the trumped event the same, and see if there would be any change in the effect. Thus suppose the major shouted "Take cover!", instead, while the sergeant ordered "Charge!". The soldiers, who hear both commands simultaneously, would have taken cover. Secondly, we imagine altering the trumped factor while keeping the trumping factor the same, and see if the effect would be any different. Suppose the major shouted "Charge!" while the sergeant shouted "Take cover!". The soldiers would have charged. Thus in the first case there would be a change in the effect, whereas in the second case there would be no change in the effect. Therefore we can conclude that it is the major's shouting, and not the sergeant's that is a cause of the soldiers' charging, according to Lewis.

But the influence approach would produce undesired results in our case. In our example, suppose we altered the height of A, say made it higher, while we kept B unaltered. The effect S would change—it would become a longer shadow. (A similar effect would ensue if we moved A towards B instead of increasing its height.) Secondly, suppose we increased the height of B while A remained fixed. The effect S *would* change again—it would become a longer shadow. (A similar effect would ensue if we moved B to the right instead of increasing its height.) In other words, there is a range of alterations that can be made on A or on B, such that the corresponding

range of alterations on *S* counterfactually depend on the alterations on A or on B. Thus, Lewis must conclude that not only the presence of A but also the presence of B influences *S*.[6] Then both A and B are independently causes of *S*, which makes A and B overdetermining causes of *S* on Lewis's influence theory. But this is contrary to our verdict above that *only* A is a cause of *S*, as B is preempted by A from causally connecting to *S*.[7]

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[6] This means that we do not have a case of trumping causation in our example: neither A nor B "trumps" the other.

[7] I thank Istvan Arányosi and an anonymous referee for their useful comments.