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CAUSATION IN PERSPECTIVE. ARE ALL CAUSAL CLAIMS EQUALLY WARRANTED?

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ABSTRACT

In a paper 'Causation in Context' (2007) Peter Menzies has argued that the truth value of causal judgments is perspective-relative (i.e. their truth value does not depend entirely on mind-independent structures). His arguments are confined to causation as difference making (a term he uses to cover probabilistic, counterfactual and regularity views of causation). In this paper we first briefly present Menzies' arguments. Then we show that perspective-relativity also holds for causation in the sense of process theories. These parts of the paper prepare the ground for the topic we really want to investigate: we want to find out whether this perspective-relativity leads to an epistemic predicament with respect to causal claims. The potential epistemic predicament we consider is that all causal claims would be equally warranted.

1. Introduction

In paper 'Causation in Context' (2007) Peter Menzies has argued that the truth value of causal judgments is perspective-relative which means that their truth value does *not* depend entirely on *mind-independent* structures:

> ... the truth-value of causal judgments does not depend entirely on the mind-independent structures. The context-sensitive character of causal judgments indicates that their truth value is perspective-relative. (2007, p. 193)

Menzies arguments in his 2007 paper are confined to causation as *difference making* (a term he uses to cover probabilistic, counterfactual and regularity views of causation). In this paper we first briefly present Menzies' arguments (Section 2). Then show that perspective-relativity also holds for causation in the sense of *process* theories (Sections 3-5).

Sections 2-5 reveal that there are different types of perspective-relativity of the truth value of causal claims. In Section 6 we summarize them and clarify how they relate to each other. In Section 7 we investigate whether the first type of perspective-relativity that we will distinguish leads to the following epistemic predicament with respect to causal claims:

(EPCC) For every causal claim we make, it is possible to formulate a conflicting causal claim that is equally warranted.

In Section 8 and 9 we do the same for the other types of perspective-relativity.

2. The Perspective-Relativity of Causation as Difference-Making

2.1 Let us look at two examples which Menzies uses to argue that "the truth conditions of causal statements are context-sensitive" (2007, p. 194). His first example is the *Indian Famine* (2007, pp. 194-195 and 209-

211). We discuss the example in such a way that it will be easy to compare Menzies' claims with what we will do with respect to process causation in Sections 3-5.

Consider a person A making the following claim:

> The famine in India in year *x* was caused by the drought, not by the failure of the government to build up food reserves.

We also have B, who claims the opposite:

> The famine in India in year *x* was not caused by the drought, but by the failure of the government to build up food reserves.

This disagreement can be explained by the fact that A and B have different perspectives. For instance, it is possible that A is trying to explain why there is a famine in India in year *x* but not in year *y*, and utters his claim in this context. If there was a drought in India in year *x*, but not in *y*, and if the Indian government did not build up food reserves in year *x*, nor in *y*, A's claim is correct within his perspective. If B, on the other hand, utters his claim in the context of explaining why there was a famine in year *x* in India but not in Pakistan, his claim is also correct, provided that there was a drought both in India and Pakistan in year *x* and that the Pakistani government (contrary to the Indian government) did build up food reserves.

Causation is used here in a counterfactual sense (one of the senses falling under the general label of "difference making"): the fact that a famine occurs in India (F) counterfactually depends on D (the fact that a drought occurs in India) and ¬R (the fact that the government did not

stockpile reserves of food). If the truth[1] of a causal claim would be context-independent, that would entail the following:

> If two people disagree as to what causes (in the counterfactual sense) an event E, then at least one of them must be wrong.

However, this claim must be rejected because there is another explanation for the disagreement:

> If two people disagree as to what causes (in the counterfactual sense) an event E, they may be explaining different contrasts.

So it is possible that, if two people disagree as to causes, they both are right within their perspective (i.e. from the point of view of what they are trying to explain). Hence, the truth of claims about causes (in the counterfactual sense) depends on the perspective taken by the person who makes the claim.

2.2 To clarify this further, we discuss a second example used by Menzies[2]:

> Let us suppose that a person is given a certain drug, 'curit', in order to cure him of a disease from which he is suffering. He can be given different doses of the drug: no dose, a moderate 100 mg dose, or a strong 200 mg dose. The drug is known to be effective in large doses, but the cost and the risk of side-effects make it impractical to give a large dose to this patient; and so he is given a moderate dose of 100 mg. As it happens,

[1] Though Menzies does not explicitly define what he means with "truth" he uses it in the sense of "warranted assertability". This is also what we mean with "truth".

[2] Menzies has adapted this example from Hitchcock 1996.

> the patient recovers; and we ask 'Did taking the moderate dose make a difference to the patient's recovery?' (2007, p. 204)

The answer to the question at the end of the quote can be 'yes' or 'no', depending on which alternative cause one has in mind to contrast with the actual case:

> [T]here are two different counterfactual cases that contrast with the actual case in which the patient is given the moderate 100 mg: the case in which he is given no dose of curit and the case in which he is given the strong 200 mg dose. (2007, p. 206)

The claim

> Taking the moderate dose was a cause of the patient's recovery.

is correct if one has in mind the first contrast case (no dose). The claim

> Taking the moderate dose was *not* a cause of the patient's recovery.

is correct if one has in mind the second contrast case (strong dose).

This example confirms a conclusion we have reached earlier, viz. that the following claim is false:

> If two people disagree as to what causes (in the counterfactual sense) an event E, then at least one of them must be wrong.

On top of the explanation given above (the persons may be explaining different contrasts), we can now give an extra potential explanation of the disagreement:

> If two people disagree as to what causes (in the counterfactual sense) an event E, they may have different alternative causes in mind.

This second example confirms the conclusion that can be drawn from the first, viz. that the truth of causal claims (in the counterfactual sense) is context-dependent, and thus depends on the perspective taken by the person who makes the claim.

2.3 To clarify Menzies' position further, it is useful to compare it with the causal pluralism defended by Christopher Hitchcock:

> There are a great many cases where we are unclear about what causes what, even though we are clear about all the facts that are supposed to constitute causal relations. (2003, p. 21)

Hitchcock maintains that this is due to the ambiguity of the meaning of "cause". This ambiguity shows itself in the fact that different relations can underpin a single causal judgement: a counterfactual relation, a probabilistic relation, a causal process, etc. Hitchcock further argued that we are in specific cases most often clear about whether or not a counterfactual relation holds between two events, whether or not a probabilistic relation holds between the two events, whether or not a causal process binds the two events, etc. This nonetheless does not necessarily lead us to a firm answer to the question whether the two events stand in *the* causal relation. This becomes very clear when the different causal relations contradict each other: e.g., an event E counterfactually depends on an event C, but is not connected to C through a causal process. Since there is no fixed hierarchy between the different relations that can underpin our causal judgements, our final judgement will depend on the choice for one or another relation as the most important one in the context. Hitchcock further argues that we should stop trying to characterize *the* causal relation, given that – in practice – we do not need an answer to this question if we are clear about which of the different causal relations is present in a specific case. If we put

Hitchcock's ideas in the format we have used above, one of the central tenets of Hitchcock is that the following claim is wrong:

> If two people disagree as to whether there is a causal relation between C and E, then at least one of them must be wrong.

This claim is wrong because there is an alternative explanation:

> If two people disagree as to whether there is a causal relation between C and E, they may be using different concepts of causation.

Menzies' perspectivalism does not contradict this. He goes one step further, by denying the following:

> If two people using the same concept of causation disagree as to whether there is a causal relation between C and E, then at least one of them must be wrong.

As we have seen in Sections 2.1 and 2.2, Menzies offers two alternative explanations: people may be explaining different contrasts (i.e., the contrasts they have in mind on the effect side differ) or have different alternative causes in mind (i.e., the contrasts they have in mind on the cause side are not the same).

2.4 To understand Menzies' position properly, it is important to point out that the use of the counterfactual conception of causation in the examples in Section 2.1 and 2.2 is not essential. Let us look back at the example from Section 2.2. We have person A claiming:

> Taking the moderate dose was a cause of the patient's recovery.

Person B claims:

Taking the moderate dose was *not* a cause of the patient's recovery.

If we assume that A and B both have a probabilistic conception of causation in mind (i.e. a conception according to which an earlier event causes a later one if the first raises the probability of the latter) their disagreement can be explained (like in Section 2.2 with the counterfactual conception) by the fact that they have different alternative causes in mind: the moderate dose raises the probability of recovery if one compares it to a situation where no drug is taken, while it does not raise the probability if one compares it to a situation where a strong dose is taken. So it does not matter which difference-making conception of causation we use: the truth value of claims about causal relations between events is perspective-relative on all difference-making conceptions of causation. That is what Menzies shows. In Sections 3-5 we will show that perspective-relativity of truth-values also applies to process causation as it has been described by Wesley Salmon: we will show that the truth value of claims about causal interactions and causal processes is perspective-relative.

3. Causal Interactions and Frames of Reference

3.1 The concept of *causal interaction* was introduced by Wesley Salmon in his book *Scientific Explanation and the Causal Structure of the World* (1984) in order to capture what he calls the *innovative* aspect of causation (the acquiring of new properties), as opposed to the *conservative* aspect, for which he developed the concept of *causal process* (see Section 4 for that).

We will adopt a definition of causal interaction that is very close to Salmon's original definition:

(CI) At t there is a causal interaction between objects x and y if and only if
- (1) there is an intersection between x and y at t (i.e. they are in adjacent or identical spatial regions at t),
- (2) x exhibits a characteristic P′ in an interval immediately before t, but a modified characteristic P immediately after t,
- (3) y exhibits a characteristic Q′ in an interval immediately before t, but a modified characteristic Q immediately after t,
- (4) x would have had P′ immediately after t if the intersection would not have occurred, and
- (5) y would have had Q′ immediately after t if the intersection would not have occurred.

An object can be anything in the ontology of science (e.g. atoms, photons, ...) or common sense (humans, chairs, trees, ...). This definition incorporates the basic ideas of Salmon. The main difference is that, according to our definition, interactions occur between two objects. In Salmon's definition, an interaction is something that happens between two processes (see Salmon 1984, p. 171). This modification was suggested in Dowe 1992. The modification is not substantial (processes are world-lines of objects, i.e. collections of points on a space-time diagram that represents the history of an object). The advantage of this terminology is that it is more convenient in analysing every-day and scientific causal talk.

Because we stick close to Salmon's original definition, we can borrow his examples. Collision is the prototype of causal interaction: the momentum of each object is changed, this change would not have occurred without the collision, and the new momentum is preserved in an interval immediately after the collision. When a white light pulse goes

through a piece of red glass, this intersection is also a causal interaction: the light pulse becomes and remains red, while the filter undergoes an increase in energy because it absorbs some of the light. The glass retains some of the energy for some time beyond the actual moment of interaction. As an example of an intersection which is not a causal interaction, we consider two spots of light, one red and the other green, that are projected on a white screen. The red spot moves diagonally across the screen from the lower left-hand corner to the upper right-hand corner, while the green spot moves from the lower right-hand corner to the upper left-hand corner. The spots meet momentarily at the centre of the screen. At that moment, a yellow spot appears, but each spot resumes its former colour as soon as it leaves the region of intersection. No modification of colour persists beyond the intersection, so no causal interaction has occurred.

One might object to the last example that there are no objects involved (if one does not regard light spots as objects) so the clauses (1)-(5) in the definitions are superfluous in this case. A clearer phenomenon that is not a causal interaction is two billiard balls lying next to each other (so condition (1) is satisfied, but the other conditions are violated).

3.2 Let us now analyse how Salmon's concept can be used in everyday or scientific causal talk. Suppose we want to make a claim about a causal interaction, of the following form:

(CCI) At t there was a causal interaction between x and y, in which x acquired characteristic P and lost characteristic P′, and in which y acquired characteristic Q and lost characteristic Q′.

Making a claim about a causal interaction presupposes a frame of reference that settles the level of description, the spatial scale and the timescale that will be used. The level of description determines the kind of system we talk about (e.g. individuals or groups of individuals,

macroscopic objects or elementary particles). The spatial scale determines the smallest unit of distance, and thus determines whether two systems are or are not in adjacent spatial regions (they are if the distance between them is smaller than the smallest unit of distance). Likewise, the timescale determines the smallest unit of time we will use, and thus allows us to distinguish between "sudden changes" as they occur in interactions, and slower evolution: we have a sudden change if and only if the change takes place in a period of time that is smaller than the smallest unit of time. Salmon does mention sudden or slow changes in his definition of causal interaction.[3] However, he refers to intervals "immediately before" and "immediately after" the intersection. His use of the word "immediately" is important for two reasons. First, it is a vague term, so we need a time scale to operationalize it. Second, it implies that, in order to have a causal interaction, the changes in the properties of the objects have to occur suddenly.

Let us clarify this by means of a series of examples. Consider a group of people in a seminar room. There is a speaker that tells his audience things that are really new to them. The seminar lasts 59 minutes. Now take the following frame of reference:

Objects = common sense macro objects
Space = rooms and multiples of them (floors, buildings)
Time = 1 hour and multiples (days, weeks, ...)

In this frame of reference, a set of interactions has occurred: the speaker and each member of his audience were in adjacent spatial regions (because they were in the same room), and a sudden change has occurred (they learned something new within 1 hour).

Contrast this with a different frame of reference:

[3] We thank an anonymous referee for pointing at this.

Objects = common sense macro objects
Space = 1 *mm* distance and multiples
Time = 5 seconds and multiples

In this frame of reference, the seminar does not constitute a causal interaction because the distances are too big and the changes are too slow. However, someone inoculating me to protect me against some disease would be causally interacting with me: there is less than 1 *mm* distance between my body and the needle of the syringe, and there is a sudden change in my body (within 5 seconds, it contains a fluid it did not contain before the interaction).

If we modify the last clause into:

Time = 0.5 seconds and multiples

the inoculation is not a causal interaction any more (because the change is too slow).

In this modified frame of reference, collisions between two billiard balls still constitute causal interactions. However, if we take smaller units of space and time, these collisions cease to be causal interactions.

We can draw two conclusions from these examples:
(a) Salmon's concept of causal interaction is a "skeleton concept": it cannot be applied to empirical phenomena until we supplement it with a frame of reference as outlined above.
(b) If something is a causal interaction given a frame of reference, refining the frame of reference is sufficient to ensure that the phenomenon fails to satisfy the conditions.

The characteristics of the use of the concept of causal interaction are a consequence of the vagueness of certain words in the definition. Salmon's vagueness has a great advantage: they entail that Salmon's definition is a polyvalent one that can be applied in many areas of science, including the social sciences (see Weber 2007 for the application

of Salmon in the social sciences). Salmon himself expresses the hope that his theory is adequate for all scientific disciplines – including the physical, biological and social sciences – except quantum mechanics (see Salmon 1984, p. 278). This brings us to a question that some readers may have asked by now: why do we use Salmon's theory rather than the conserved quantity theory developed by Phil Dowe (1992, 2000)? The reason is that the latter theory is clearly unable to get a grip on causal-mechanical causation outside the realm of physics. Salmon's theory is the only one that sheds light on the meaning of causal-mechanical claims outside the realm of physics. So we have to use that one if we want to cover everyday causal talk and all areas of scientific causal talk.

Before investigating the epistemological consequences of (a) and (b), we want to urge that scientists are at complete liberty when choosing a frame of reference. They can make a clever choice, or a choice that is not very clever. Consider a psychologist investigating the group of people in a seminar room mentioned above. The psychologist is interested in exchange of knowledge. If the spatial scale he chooses is too refined, none of the phenomena he is interested in will turn out to be causal interactions (because the people are too far away from each other). If the spatial scale is appropriate, some phenomena (successful exchanges in which one person learns something from another) come out as causal interactions, while other phenomena (failed communication) comes out as an intersection which is not a causal interaction. Clever scientists in a given discipline will use an appropriate frame of reference for their domain: a frame of reference in which some phenomena in which they are interested constitute causal interactions, while others don't. However, the fact that not all frames of reference are equally good (and that most scientists quasi-automatically choose an appropriate frame of reference) should not let us forget the basic points: we cannot use the concept of causal interaction without choosing a frame of reference (see (a) above), and this choice has consequences for what we label as "causal interaction" and what not (see (b) above).

4. The Consequences for the Truth Values of Causal Claims

Let us now consider the epistemological implications of (a) and (b). Consider a person A making the following claim:

> This collision between two billiard balls is a causal interaction.

We also have B, who negates this:

> This collision between two billiard balls is a *not* a causal interaction.

We assume that both have definition (CI) in mind and apply it correctly (i.e. call something a causal interaction if and only if it satisfies all the conditions). Then there are two possible causes of the disagreement. One is that A and B use different frames of reference in applying the definition. The other is that one of them has inadequate empirical evidence, and therefore makes a wrong judgment.

If the truth of a claim about causal interactions would be framework-independent, that would entail the following:

> If two people disagree as to causal interactions then at least one of them must be wrong.

However, this claim must be rejected because there is another explanation for the disagreement:

> If two people disagree as to causal interactions, they may have a different frame of reference.

So it is possible that, if two people disagree as to causal interactions, they both are right within their frame of reference. Hence, the truth of claims about causal interactions is framework-dependent.

Before looking at causal processes, it is useful to explore further what is going on here. By choosing a frame of reference, we adopt a set of *norms*: a norm about what is *big enough but not too big* to count as an object, a norm about what is *close enough* to count as 'adjacent' and a norm about what is *fast enough* to count as 'immediately'. The claim that something is a causal interaction is the result of a comparison of factual information with these norms, just a legal verdict (e.g. "This person is guilty of theft") is the result of a comparison of factual information with legal norms.

5. Causal Processes

5.1 Causal mechanisms are more than complexes of causal interactions. Causation also has a *conservative* aspect: properties acquired in causal interactions are often spontaneously preserved, in what Salmon calls *causal processes*. Salmon divides processes (world lines of objects) into causal processes and pseudo-processes. Causal processes are capable of transmitting marks, pseudo-processes cannot transmit marks. Mark transmission is defined by Salmon as follows:

> Let P be a process that, in the absence of interactions with other processes, would remain uniform with respect to characteristic Q, which it would manifest consistently over an interval that includes both of the space-time points A and B (A≠B). Then a *mark* (consisting of a modification of Q into Q′), which has been introduced into process P by means of a single local interaction at point A, is *transmitted* to point B if P manifests the modification Q′ at B and at all stages of the process between A and B without additional interventions. (Salmon 1984, p. 148)

Salmon mentions material objects and electromagnetic waves as examples of causal processes. This is quite strange: a process is a world line of an object, so it is very awkward to call some objects causal processes. We have to make a clear distinction between objects and world lines of objects. If we make this distinction, we can also distinguish between objects that have the capacity to transmit certain modifications of their structure to other spatiotemporal regions (like e.g. material objects) and world lines of such objects (= causal processes). The movement of a material object is a process (world line of an object). Moreover, it is a causal process: the underlying object has a capacity to transmit marks. But the material object itself is not a causal process, since it is not a process. The movement of an object is a causal process, but the moving object itself is not.

Like the concept of causal interaction, the concept of causal process presupposes an underlying reference frame which specifies the objects and the time and space scales. Take for instance a person that has no contact with anybody else for two weeks. This person *can be seen* as transmitting a mark (for instance: the beliefs he has) even if he eats, drinks, breathes and interacts in various other ways with his non-human biological environment. The beliefs *can be seen* as spontaneously preserved because no intervention of other human beings (e.g. through communication) is necessary to preserve them. The phrases we put in italics ("can be taken" and "can be seen") are crucial because strictly speaking there is no mark transmission. The requirement that the mark is preserved "without additional interventions" (cf. the last sentence of the definition of mark transmission) is not satisfied: the interactions with the biological environment are necessary to preserve the belief (without the interactions, the person dies and the belief disappears). However, it is possible to classify causal interactions into groups, e.g. biological interactions and non-biological interactions. To see why such a distinction is useful, consider a person A with a good memory, and a

person B with a very bad memory (B needs repetition of the message to be remembered every hour). The claim that the content of the message is transmitted without additional *non-biological* interactions is true for A and false for B. The claim that the content of the message is preserved without additional interactions *tout court* is false for both A and B (without breathing, both A and B die). A clever scientist who is interested in phenomena related to memory will therefore disregard biological interactions when applying the concept of causal process. The result will be that he says that in A there is a mark that is transmitted, while in B there is no mark transmission.

What is the upshot of this? If we want to use the concept of mark transmission and causal processes outside the realm of physics, we first have to make a decision about which types of causal interactions we will neglect. Without such a decision, the concepts become useless (because nothing in the domain we want to study will be a causal process). As with the frames of reference discussed in Section 3, scientists can make clever and non-clever choices about which types of causal interactions to neglect. Of course most scientists quasi-automatically make appropriate choices, but still there is a choice to be made.

5.2 The fact that mark transmission and spontaneous preservation are relative to a choice about causal interactions to be neglected, has epistemological implications similar to the ones we described in Section 4 with respect to causal interactions. If the truth of a claim about causal processes would be framework-independent, that would entail the following:

> If two people disagree as to causal processes then at least one of them must be wrong.

However, this claim must be rejected because there is another explanation for the disagreement:

> If two people disagree as to causal processes, they may have taken different decisions about types of causal interactions to neglect.

So it is possible that, if two people disagree as to causal processes, they both are right within their framework. Hence, the truth of claims about causal processes is framework-dependent.

6. Types of Perspective-Relativity: Overview and Comparison

The aim of Sections 3-5 was to show that the truth value of claims about causal interactions and causal processes are perspective-relative. Menzies has shown that the truth of causal claims in the difference making sense is perspective-relative in *two* specific ways: the truth value may depend on the contrast that is explained (Section 2.1), or on the alternative causes we have in mind (Section 2.2). What we have shown in 3-5 is that the truth value of claims about causal interactions is perspective-relative in a *third* way (it depends on the choice of a frame of reference with objects, time scale and spatial scale) and that the truth value of claims about causal processes is perspective-relative in a *fourth* way (it depends on a choice about types of causal interactions to be neglected). Distinguishing these four ways is important because "perspective" is a vague term and, as a consequence, the claim that the truth value of causal claims is perspective-relative is also rather vague. The challenge for defenders of perspective-relativity of causal claims is not only to show *that* there is such a perspective-relativity, but also to show *what it consists in*. Menzies has done that for difference making concepts of causation, we have done it for causal interactions and causal processes. The results may be summarised as follows:

Perspective-relativity of causal claims *comes in at least two types*			
Context-dependence, *which comes in at least two subtypes*		Framework-dependence, *which comes in at least two subtypes*	
Dependence on contrast to be explained	Dependence on alternative causes considered	Dependence on frame of reference (objects, time, space)	Dependence on decision about types of causal interaction to be neglected
Type 1	*Type 2*	*Type 3*	*Type 4*

These four types are interesting in themselves because they give a positive content to perspective-relativity. However, in this paper they mainly function as a way to structure the discussion: we discuss the consequences of type 1 in Section 7, type 2 in Section 8 and types 3 and 4 in Section 9.

7. Dependence on the Contrast to be Explained and (EPCC)

Dependence on the contrast to be explained (perspective-relativity of type 1) reveals that disagreements on causal claims are sometimes due to a specific feature of natural language, viz. that people sometimes do not distinguish clearly between causation (a relation in the world) and causal explanation (an epistemic relation between propositions). There is a systematic way to disambiguate the claims that are at stake: use the term

"cause" to denote causal relations in the world and "causally explains" to denote the epistemic relation.[4]

Let us illustrate this by means of the example of 2.1. The initial situation is that A accepts this:

> The famine in India in year *x* was caused by the drought.
> The famine in India was not caused by the failure of the government to build up food reserves.

Person B rejects these claims. After agreeing that the term "cause" should only be used to denote difference-making relations in the world, it is very well possible that A and B agree about the following (we use italics to denote that there has been a shift in the meaning of the word "cause"):

> The famine in India in year *x* was *caused* by the drought.
> The famine in India in year *x* was *caused* by the failure to build up food reserves.

Suppose that A and B also agree the about the following factual claims:

> There was drought in Pakistan in year *x*.
> The Pakistani government built up food reserves in year *x*.

Under this assumption, A and B will also agree to accept the following claim:

> The difference in famine between India and Pakistan in year *x* is *causally explained* by the failure of the Indian government to build up food reserves.

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[4] We thank Anjan Chakravartty for pointing at this.

And they would agree to reject the following claim:

> The difference in famine between India and Pakistan in year *x* is *causally explained* by the drought.

The latter claim would be rejected not because it conflicts with their causal beliefs, but because it conflicts with their factual beliefs (this claim presupposes the factual belief that there was no drought in Pakistan in year *x*).

Complete agreement is not the only possible outcome of the disambiguation process. It is also possible that it reveals a deeper disagreement about which causal relations there are in the world. For instance, it is possible that after disambiguation A and B find out that they disagree about whether food reserves can prevent famines or not. The disambiguation process may also reveal disagreements about factual beliefs (while there is agreement in causal beliefs in the strict sense). In both cases, the initial disagreement is resolved and replaced with a more fundamental disagreement.

The upshot of this is that perspective-relativity of type 1 does not support (EPCC) because the conflict is only apparent. More careful use of the term "cause" either makes the conflict disappear or reveals a serious but different conflict.

8. Dependence on the Alternative Cause and (EPCC)

We distinguish here between standard and non-standard difference-making claims. Standard difference-making claims are those in which the alternative cause is *not* explicitly mentioned. Claims that do explicitly mention the alternative cause are labelled *non-standard*. The labels

reflect a property of natural language: most claims we make are standard claims, non-standard claims do not occur very often.

Below we will argue that dependence on the alternative cause does not support (EPCC) either. However, it supports a weak variant of it:

(EPCC*) For every *standard* difference-making claim we make, it is possible to formulate a conflicting difference-making claim that is equally warranted.

We use the example of 2.2 to illustrate this. We start with a standard claim:

Taking the 100 mg dose was a cause of the patient's recovery.

Assume that we accept this claim after a reasoning process in which we have compared the 100 mg dose with taking no dose at all. It then suffices to repeat the same line of reasoning with a 99 mg or 101 mg dose as alternative cause in order to arrive at the following, equally warranted conclusion:

Taking the 100 mg dose was *not* a cause of the patient's recovery.

In general, it suffices to take an alternative cause that is close enough to the real cause event in the original causal claim in order to arrive at a conflicting but equally warranted claim which denies the causal relation put forward in the original claim. This supports (EPCC*).

Now consider the three corresponding non-standard claims:

Taking the 100 mg dose, as opposed to no dose, was a cause of the patient's recovery.
Taking the 100 mg dose, as opposed to a 99 mg dose, was not a cause of the patient's recovery.

> Taking the 100 mg dose, as opposed to a 101 mg dose, was not a cause of the patient's recovery.

By building in the perspective into the claim, we now have claims that do not conflict with each other. So for non-standard claims it is impossible to create conflicting equally warranted claims. This is why perspective-relativity of type 2 does not entail (EPCC).

The line of reasoning developed till now in principle still allows for a form of relativism: if all perspectives would be equally good (i.e. equally interesting from a practical or theoretical point of view) it would suffice picking an appropriate perspective if you want to accept or reject some causal claim[5]. However, not all perspectives are equally interesting. Comparing a 100 mg dose to a 99 mg dose is arguably less interesting than comparing it to no dose. In general, it is important to see that, as soon as we make non-standard claims, disagreements may arise about whether some causal claims (made within a certain perspective) are *interesting*. That is the price we have to pay for avoiding the epistemic predicament of conflicting equally warranted difference-making claims.

9. Frame-Work Dependence and EPCC

We start with perspective-relativity of type 3 (dependence on frame of reference). As in Section 8, it is useful to introduce a distinction between standard and non-standard claims. Standard causal interaction claims are those in which the frame of reference is *not* explicitly mentioned. Claims that do explicitly mention the frame of reference are labelled *non-standard* causal interaction claims. Again, the labels reflect a property of

[5] We thank Anna-Sofia Maurin for pointing at this.

natural language: most claims we make are standard claims, non-standard claims do not occur very often. With this terminology in place, we can formulate a second weakened version of (EPCC):

(EPCC**) For every *standard* causal interaction we make, it is possible to formulate a conflicting causal interaction claim that is equally warranted.

Let us give an example, which has the same structure as the example of Section 8. We start with a standard claim:

This collision between two billiard balls is a causal interaction.

Assume that we accept this claim after a reasoning process in which we have used common sense objects, 1 *mm* as smallest spatial unit and 1 *sec* as smallest time unit. Within this framework (which we label framework [O,S,T]), the conditions of (CI) are satisfied. It then suffices to repeat the same line of reasoning with molecules as entities and a much smaller spatial scale and time scale (let is call this framework [O′,S′,T′]) in order to arrive at the following, equally warranted conclusion:

This collision between two billiard balls was not a causal interaction.

Within the second framework the collision involves too many objects that come not close enough to each other, and the changes are much too slow. In general, it suffices to take a sufficiently more fine-grained frame of reference in order to arrive at a conflicting but equally warranted claim which denies that there was a causal interaction. This supports (EPCC**).

Now consider the corresponding non-standard claims:

Within framework [O,S,T], this collision between two billiard balls is a causal interaction.

Within framework [O′,S′,T′], this collision between two billiard balls is not a causal interaction.

By building in the perspective into the claim, we now have claims that do not conflict with each other. So for non-standard claims it is impossible to create conflicting equally warranted claims. This is why perspective-relativity of type 3 does not entail (EPCC). A parallel argument can be developed for perspective-relativity of type 4 (dependence on types of causal interactions that are neglected).

As in Section 8, there still can be some form of epistemic relativism if all frames of reference are equally interesting. However, as we have already argued at the end of Section 3, this is not the case.

10. Conclusion

The bulk of this paper was devoted to showing that the truth value of claims about causal interactions and causal processes is perspective-relative (Sections 3-5). Combining this result with the work of Menzies enabled us to distinguish different types of perspective-relativity (Section 6). In Sections 7 till 9 we have shown that none of the types of perspective-relativity we have distinguished leads to epistemic relativism.

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