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ORIGINAL PAPER

Minimal Theory of Causation and Causal Distinctions

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Abstract
The Minimal Theory of Causation, presented in Graßhoff and May, 2001, aspires to be a version of a regularity analysis of causation able to correctly predict our causal intuitions. In my article, I will argue that it is unsuccessful in this respect. The second aim of the paper will be to defend Hitchcock's proposal concerning divisions of causal relations (presented in Hitchcock, 2001) against criticism made, in Jakob, 2006 on the basis of the Minimal Theory of Causation.

Keyword The minimal theory of causation · INUS · Regularity theory of causation · Causal distinctions

1 Introduction

The Minimal Theory of Causation, presented in Graßhoff and May (2001), aspires to be a version of a regularity analysis of causation able to correctly predict our causal intuitions. In my article, I will argue that it is unsuccessful in this respect. The second aim of the paper will be to defend Hitchcock's proposal concerning divisions of causal relations (presented in Hitchcock, 2001) against criticism made, in Jakob (2006) on the basis of the Minimal Theory of Causation. In the second section, I will present the Minimal Theory and Jakob's critique. In the third one, I will critically examine both of them. In the last section I will conclude.

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2 Minimal Theory of Causation

The Minimal Theory of Causation (MT) is a version of a regularity theory of causation. It was proposed in Graßhoff and May (2001) and it both builds on and is motivated by shortcomings of the Mackie's INUS theory (e.g., Mackie (1980)). Therefore, I will start by introducing the INUS theory. According to the theory, a cause of an event is insufficient but necessary (non-redundant) part of unnecessary but sufficient condition of this event, in short, its INUS condition. A classic example used to present the theory is a case of a fire. When experts judge that the short-circuit is the cause of the fire, they are aware that it was just a part of a set of conditions which together are sufficient for the fire. The set includes the presence of oxygen, flammable material etc.. At the same time, the short-circuit was necessary in the described situation, without it there would be no fire. The set of conditions is not necessary for the fire. There are other sets of conditions sufficient for fire, for example, an arsonist with gasoline and a lighter. Therefore short-circuit is insufficient but necessary (non-redundant) part of unnecessary but sufficient condition or a cause of the fire. This is a good prediction. Due to its predictive capability, the theory is popular among scientists. For example, Marini and Singer (1988) describes how Mackie's theory is used in social science. Similarly, Warr (2016) argues that INUS theory is the most suitable one for criminology because it is simple and easy to use and, at the same time, able to incorporate multidimensional explanations.

On the other hand, the theory is currently not popular among philosophers, especially in comparison to the interventionists theories (e.g., Woodward (2005)) or causal models (e.g., Pearl (2009)). One reason for that may be notorious counterexamples, for example, the Manchester factory hooters case. The example was formulated by the Mackie himself:

> "The sounding of factory hooters in Manchester [at 5 p.m.] may be regularly followed by, but does not cause, London workers leaving their work." (Mackie (1980), p.81)

Because of the regularity and the temporal order the sound will be recognized as an INUS condition and therefore cause of workers leaving. This is an unintuitive result and it was recognized as a problem by Mackie himself. The Minimal Theory of Causation, proposed in Graßhoff and May (2001), preserves intuitions behind the INUS theory but does not suffers from the traditional problems. In words of Jakob (2006):

> "At first sight, MT bears a close resemblance to Mackie's (1974) INUS-conditions, but a second glance will show that some important lessons have been learned." (Jakob 2006, p. 280)

Surprisingly MT did not get much traction since. It clearly possesses many attractive features. Firstly, it shares already mentioned attractive features of INUS but is not susceptible to the counterexamples. Additionally, it provides a unified theory of singular and general causation.

In light of all that, it is surprising that the theory did not attract more supporters. Perhaps the problems I will diagnose in my paper can be part of the explanation as to why INUS is not popular anymore and MT, despite having attractive properties, never gained much popularity.

In my presentation of MT I will use a version of the theory presented in Jakob (2006). It is constituted by causal principles, which constrain all deterministic causal relations:

> "*Principle of causal determinism*: The same cause is always accompanied by the same effect." (Jakob 2006, p. 280)

This principle "defines the essence of deterministic causation".[1] On the other hand, it makes the theory unable to deal with probabilistic causal relations. In most cases of probabilistic causation, different effects can be caused by the same cause.

> "*Principle of causality*: If no cause is present, no effect occurs." (Jakob 2006, p. 281)

It claims that whenever an event type has a cause, then if an event from this type occurred, at least one of his causes had to occur. In other words, it prohibits spontaneous occurrences of effects.

> "*Principle of causal relevance*: Every type of cause is indispensable for the occurrence of an effect in at least one situation." (Jakob 2006, p. 281)

This principle prevents the theory from accepting as cause an event which just happens to coincide with the effect. In order to be classified as a cause by the theory an event has to be necessary for at least one occurrence of a given effect.

> "*Principle of persistent relevance*: An event type maintains its causal relevance when additional event types are taken into account." (Jakob 2006, p. 281)

The last principle makes possible for the theory to exclude relations which are not persistent enough.

After he presented the principles, Jakob defines a causal relation which obeys them. He starts by defining a *minimally sufficient conjunction:*

> "**MsC**: A conjunctive sufficient condition ϕ of an event type θ is a *minimally sufficient conjunction* of θ, if and only if no proper part of ϕ is sufficient for θ." (Jakob 2006, p. 281)

where and θ designate event types and "proper part of ϕ" is a disjunction which is composed of disjuncts of ϕ but contains fewer elements than ϕ. There can be many different minimally sufficient conjunction for one effect. The disjunction of all of them is, because of the Principle of causality, a necessary condition. We called a necessary condition of x a *minimally necessary condition* if and only if none of its proper parts is a necessary condition of x.

[1] Graßhoff and May (2001) p. 88.

Using previously defined notions, he defines a *minimal theory*:

> "A minimally necessary disjunction of minimally sufficient conditions of *E* is called a *minimal theory* of *E*." (Jakob (2006, p. 282)

Then, with use of the intuition expressed in the principle of persistent relevance he defines causal relevance, which is at the same time his definition of type-level causality:

> "**CR**: An event type *C* is *causally relevant* for an event type *E* if and only if (i) *C* is part of a minimal theory of *E*, and (ii) *C* stays part of this minimal theory across any extensions of its frame of event types." (Jakob 2006, p. 282)

The final notion is a singular causation which was not defined in Graßhoff and May (2001):[2]

> "**SC**: Two events *c* and *e* stand in a singular causal relation if and only if *c* instantiates a positive event type *C* which, according to **CR**, is causally relevant for an event type *E*, such that *e* instantiates *E*, and *c* is coincident with other events that instantiate a minimally sufficient condition *CX* of *E*, in which *C* is contained." (Jakob 2006 p. 283)

Before I move to the critical part of my paper, I will present one of application of MT, Jakob's critique of Hitchcock's distinctions of causal relations. I will start by presenting the distinctions. Hitchcock (2001) develops two complementary distinctions in order to clarify and explain one way in which we use causal claims, namely as advice. According to him, the distinctions are conflated in a traditional distinction of causal relations, which distinguishes between singular and general causal relations. (S) is an example of a singular causal claim while (G) of a general one:

(S) David's smoking caused him to develop lung cancer.
(G) Smoking causes lung cancer.

The first of Hitchcock's distinctions distinguishes between actual and tendency causation. Actual causal claims imply that the arguments of a relation actually occur. (S) is an example of an actual causal claim while (G) is a causal tendency claim. Another causal tendency claim is:

(T) David is the sort of person for whom smoking tends to cause lung cancer.

The second distinction divides causal claims into narrow and wide. Narrow causal claims describe relations between single events or between homogeneous populations. Examples of such narrow claims are (S) or (T). Wide causal claims describe relations between "broader, more heterogeneous populations"[3] examples of such claims are (G) or:

[2] Where capital Latin letters denote event types, while small letters denote events.
[3] Hitchcock (2001) p. 220.

(W) Every year, there are thousands of new cases of lung cancer that are caused by smoking.

Hitchcock claims that these are conflated in commonly used distinction into general and singular causation and that the new distinctions cannot be expressed in terms of the old one.

Using the framework of MT, Jakob revises Hitchcock's distinctions. He starts with actual/tendency distinction. According to Jakob, the most relevant cases are the relations which are classified as single causation by the standard division and as tendency causation by Hitchcock's distinction, for example (T). According to MT, a claim is a singular causal claim just if it refers to particular events standing in causal relations. (T) does not refer to any such events and therefore is classified as a general causal claim. The meaning of (T) is, according to MT, captured by the following two clauses:

"(i) Smoking *S* is causally relevant for lung cancer *L*.
(ii) David instantiates a conjunction of event types *X* together with which smoking is a minimally sufficient condition *SX*, which is part of a minimal theory of *L*."

The first clause describes existence of the general causal relation between smoking and cancer. The second one states that David instantiates all parts of a minimally sufficient condition of lung cancer except smoking. In other words, the only thing he lacks to get lung cancer is smoking. Neither of the clauses imply occurrences of events which are arguments of the relation (David's smoking and cancer) and therefore (T) is a general causal claim.

In opposition to (T), (S) is a singular causal claim. It is so because it refers to two particular events, namely David's smoking and developing lung cancer, standing in the causal relation. According to MT its content can be characterized as:

"(i) Smoking *S* is causally relevant for lung cancer *L*, and
(ii') David instantiates a minimally sufficient condition SX_i containing smoking *S*, and SX_i is part of a minimal theory of *L*."

The first clause of the meaning of (S) is the same as the first clause of the meaning of (T). Both (S) and (T) describe a causal relation between smoking and lung cancer. The second clause of the meaning of (S) states that David instantiates the whole minimal sufficient condition which includes smoking. (W) is also a singular causal claim, the difference between it and (S) is just the number of persons who instantiate a relevant minimally sufficient condition. Finally, (G) is a typical case of general causal claim, its meaning, according to the author, is exhausted by:

"(i) Smoking *S* is causally relevant for lung cancer *L*."

(G) does not imply anything about occurrence of any actual events, which makes it a general causal claim. If a claim is general according to MT, it is not an actual claim

in Hitchcock's sense. Therefore according to Jakob the actual/tendency distinction does not add anything.

Then Jakob discusses the division into wide and narrow causal claims. Hitchcock classifies (S) as an example of wide causal claims while (W) as a narrow one. According to Jakob's analysis, both claims share (i) as part of their meaning and differ just in the attribution of smoking-involving minimal necessary condition. (S) attributes it to David while (W) to thousands of cases. Therefore, both sentences differ just in a number of instantiations they describe, not in the nature of the expressed causal relations.

Jakob concludes that his distinction classifies the presented cases just as well as two Hitchcock's distinctions, and for sake of methodological parsimony we should use it.

3 Critique

In this section, I will present some problematic features of the Minimal Theory of Causation and Jakob's critique. Firstly, I will raise some general worries concerning MT. Afterwards, I will show how they translate into problems in Jakob's analysis of meaning of causal claims and his reformulation of singular/general causal claim distinction. Lastly, I will present one way in which Hitchcock's distinctions are superior over Jakob's one.

MT does not seem to be a promising theory of causation. One of the purposes of such theory is to predict causal intuitions of natural language speakers. MT fails to deliver in this respect in at least two different ways:

It is too restrictive. Firstly, a causation by omission is excluded from the analysis. Moreover, it seems that we would have to significantly change the theory in order to incorporate omissions. For example principle of causal determinism seems to be generally false for causation by omission. We can say that a lack of seat belts is a cause of a serious damage in the case of an accident, but it will not have the same effect in different situation. Secondly, as Jakob's himself admits, MT excludes probabilistic causation: "If there are irreducibly probabilistic relations the MT-analysis does not apply to them."[4] The situation seems to be worse than Jakob admits. The theory not only excludes cases of indeterministic causation but also does not give us any answer in cases in which we do not know the deterministic mechanism behind the connection. Arguably, (G) is one of such cases. This seems problematic if we consider uses of causal concepts in contexts in which we have just statistical information.

Some of the axioms of MT are counter-intuitive. For example, the Principle of causal determinism seems to cause the above problem. Similarly, the Principle of causality seems counter-intuitive. Consider, for example, an alternative world which contains rare cases of spontaneous occurrence of lung cancer. Contrary to the

[4] Jakob (2006) page 280.

Principle of causality, in such alternative world we would still have been entitled to state (G).

Finally, the analysis of meaning of causal claims, based on MT article seems to be unsuccessful. Consider for example (T)-like sentence:

(I) Scarlett Johansson is the sort of person for whom contact with grass pollen tends to cause a skin rash.

According to Jakob's analysis the meaning of (I) is:

(i) Contact with grass pollen *P* is causally relevant for skin rash *R*, and
(ii) Scarlett Johansson instantiates a conjunction of event types *X* together with which contact with grass pollen is a minimally sufficient condition *PX*, which is part of a minimal theory of *R*.

Neither of the clauses imply occurrences of events which are the arguments of the causal relation and therefore (I) is a general causal claim. But (I) does not seem to convey nothing about anybody except Scarlett Johansson. Why it is a general causal claim? And why we should accept (i) as a part of its meaning? There is a possible answer, namely that the causal relevance in (i) is a very weak notion and therefore (i) does not add much. This seems to be plausible if we consider how causal relevance is understood in MT. On the other hand, the answer starts to be very unintuitive if we remind ourselves that the meaning of (G) and (G)-like sentences are exhausted by (i) and (i)-like clauses. It seems obvious that we mean something stronger when we state (G).

The problem is clear when we consider (I) together with its wide[5] equivalent:

(J) Contact with grass pollen causes skin rash.

The meaning of (J) is:

(i) Contact with grass pollen *P* is causally relevant for skin rash *R*.

If we compare both meanings it is clear that according to Jakob's analysis (I) is stronger then (J). This means that we can infer (J) from (I) but not the other way around. This seems false. (I) is true, but (J) seems false. Therefore the theory seems to be in trouble.

We can ask here, what went wrong? The most obvious answer is that the meaning of general causal claims like (G) or (J) predicted by MT is much to weak. It is imposed by the principle of persistent relevance and the principle of causal relevance. Both principles can be satisfied by a single instance and therefore the truth conditions for a general causal claim are easy to satisfy. It is enough that one

[5] It is wide in Hitchcock's terminology; in Jakob's one both (I) and (J) are general.

member in a given population (e.g., Scarlet Johansson in population of humans) instantiates a given causal tendency for the whole population to instantiate it. This is reflected in implausible predictions concerning meanings of causal claims. It seems that we mean something stronger when we use general causal claims.

The Jakob distinction is also unintuitive. A claim is a singular causal claim, according to the MT, if it refer to actual events standing in causal relation. If a clause is not a singular causal claim it is general one. Because of this, claims like (I) which refers to a tendency instantiated by a single instance are classified as a general causal claims. This seems to be at least misleading. (I)-like sentences do not describe anything general so why we should classify them as general causal claim?

Similarly, it seems that Hitchcock's distinctions are more fruitful. To see that let us go back to the aim of the Hichcock's article, namely an analysis of causal claims used as advices. Hitchcock's distinctions can be used to single out the type of causal claims which are the most naturally used in this role – the wide tendency causal claims. At the same time, the Jakob's distinction cannot do that, or at least, cannot do that in a similarly elegant way. Plausibly, the subset of general causal claims would be most suitable to serve in this way. At the same time it is not clear if it can be described more precisely. Therefore at least in this respect, Hitchcock's distinctions perform better than Jakob's distinctions.

4 Conclusion

In my paper I argued that MT is not a promising theory of causation. As we have seen, the analysis is both too restrictive (it excludes causation by omission and probabilistic causation) and at the same time not restrictive enough (the predicted meaning of general causal claims is too weak). Moreover, it seems that there is no way in which we can solve these problems without changing the theory in a substantial way.

One interesting question we can ask is: Are the features which cause the implausible predictions of MT present in its predecessor Mackie's INUS theory? As we have seen the main problem with MT is that it is too lenient in the way it classifies factors as general causes. It is enough for a class to be judged as a cause of some other class if one event from the first class is part of minimally sufficient condition for an event from the second class. This seems to be way too lenient criterion and analogical leniency is already present in INUS. As we have seen according to the theory, a cause of an event is insufficient but necessary (non-redundant) part of unnecessary but sufficient condition of this event. To see the analogy we can go back to our example of the case of a fire. In this case, the short-circuit is insufficient but necessary (non-redundant) part of unnecessary but sufficient condition or a cause of the fire. The prediction is plausible but let us consider what Mackie is saying about other conditions being part of the sufficient set (in our case presence of oxygen and flammable material etc.):

> "That is, the formula "$AB\bar{C}$ or $D\bar{E}F$ or $\bar{G}\bar{H}I$ or . . ." represents a necessary and sufficient condition for the fire, each of its disjuncts, such as '$AB\bar{C}$', represents a minimal sufficient condition, and each conjunct in each minimal sufficient condition, such as 'A' represents an INUS condition." (Mackie (1980) p. 246)

Surprisingly, Mackie is writing here that all other individual conditions which are parts of all sufficient but unnecessary conditions are INUS conditions and therefore causes. This is puzzling, there seems to be too many causes. First of all, the presence of oxygen and all other implicit conditions are all causes of the fire. Secondly the quote seems to suggests that conditions which are members of unrealized unnecessary sufficient sets are also causes. This is perhaps an uncharitable interpretation. In any case, the attribution of causality to factors other then short-circuit seems to be less intuitive. Moreover, as far as I can tell, the theory does not give us any way to explain why short-circuit seems to be more important as a cause of fire than any other INUS condition. To put it otherwise, INUS theory is not able to distinguish the cause from the contributory causes. This problem is analogical to the problem with MT. According to INUS theory it is enough for a singular causal claim that a given event is a insufficient and necessary part of any of many sufficient but unnecessary condition, no matter how unlikely or exotic this condition is. Similarly, according to MT theory, it is enough that a one member in a given population (e.g., Scarlet Johansson in a population of humans) instantiates a given causal tendency for the whole population to instantiate it. The problem was already present in INUS theory but going from singular to general causal claims seems to make it worse.

As we have seen, contrary to the main claim of Jakob's article, it seems that Hitchcock's distinctions perform better then the new distinction defined on the basis of MT. The new distinction classifies some of the claims in a misleading way for example, it classifies (I) as a general causal claim.

Finally, we can ask if there is a part of Jakob's critique which remains valid? I think that there is. In the last part of his article Jakob points out that the second of two Hitchcock's distinctions, the one which distinguishes between wide and narrow causal claims, does not describe two semantically different kinds:

"The essential qua necessary difference between (S) and (W) is the mere number of instantiations which is one in (S) and thousands in (W). This difference has nothing to do with the nature of the causal relations expressed in (S) and (W)..."[6]

This seems true, as the first distinction does all the semantic work. It seems plausible that many instances of relations analogical to the one which makes (S) true would make (W) true. Plausibly, the difference between wide and narrow causal claims is no more semantically significant than the difference between "wide" and "narrow" categorical claims like:

(L) David have lung cancer.
(M) There are thousands of cases of lung cancer.

On the other hand, this does not make the second distinction unimportant. As we have seen it has both epistemic and pragmatic importance.

[6] Jakob (2006) page 286.

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