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Causation as transference and responsibility

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During the last decades there has been a remarkable renewal of interest in theories of causation which is linked to the decline of the orthodoxy of the Logical empiricist school. A number of alternatives to the traditional covering-law account have been proposed. I shall defend a version of an approach that has been undeservedly neglected: the Transference Theory (TT) of causation. Accounts of this type elaborate the intuition that there is a material link between the cause and the effect, consisting of something transmitted between them.

I shall start from the following basic thesis (T).

(T) Two events c and e are connected by a causal relation if and only if there exists a conserved quantity Q which is exemplified by both c and e and of which a particular amount A is transmitted between c and e .

The notion of a conserved quantity (CQ) figures prominently in this version of Transference Theory (TT). It was an important shortcoming in earlier versions of TT that they couldn't provide a justification of the list they proposed of entities transference of which is claimed to be the basis of causation. Their lists of such entities, such as energy, momentum, or force, seemed arbitrary. The idea of transference itself provides the crucial constraint: Only what is conserved can be transmitted. We can appeal to physics for providing both theoretical grounds for the existence of CQ, and a provisional list of such quantities. (T) implies the thesis that it is amounts of CQ, the transference of which is necessary and sufficient for causation.¹

This thesis sets my proposal apart from two theories of causation which have recently been put forward and which, upon a first look, one might be tempted to assimilate to some version of TT. These theories are Phil Dowe's (1992) conserved quantity theory and Douglas Ehring's (1997) trope persistence theory.² Both deny that transference is what is crucial for causation. For Dowe, what makes a process causal is the "manifestation" of a CQ, but he

¹One can find a precursor of this idea in Castaneda (1984) who recognises that causes transfer something to the effect, but wants his philosophical account to remain neutral upon the question of just what it is that is transferred between them. "Neutrally, so as to beg no empirical issues, let us dub *causity* that, in general, which is characteristically transferred from the causal network to the effectal network" (Castaneda 1984, p. 22/3; emphasis Castaneda's).

²It is certainly not an accident, but due to a widespread renewal of interest in the metaphysics of *tropes*, that Ehring (1997) and I (Kistler 1998; 1999) have independently put forward an account of causation in which tropes play a crucial role. Indeed, Keith Campbell and David Armstrong among many others have recently taken up a term coined by Donald Williams (1953) to promote the study of this neglected type of entity. Although the history of the concept can be traced back at least to Aristotle's individual accidents (See, e.g., *Categories* 1a27), it is the interest in a powerful nominalistic ontology which has motivated contemporary studies of tropes, "abstract particulars", or "particularised properties" as they are also called.

denies that individual amounts of CQ can be transferred. Ehring has more metaphysical objections to the idea of transference and tries to ground the causal link on "persistence" instead of transference; moreover, he doesn't give a special role to CQ. In what follows I shall confront TT to Ehring's objections.³

Ehring's criticisms of TT have been so successful that many authors seem to consider it as definitely refuted. For John Carroll, e.g., Ehring's (1986) arguments against TT are strong enough to disqualify it as a serious candidate who might provide any "reason for thinking that causation is analysable in purely noncausal terms" (Carroll 1994, p. 120, note 4). It is indeed undeniable that Ehring (1986) presents a number of strong arguments against Aronson's (1971) and Fair's (1979) versions of TT, arguments which he partly takes up again in his book *Causation and persistence* (Ehring 1997).

Some of these criticisms can be overcome by our version of TT, based on thesis (T). However, some other of Ehring's criticisms call for supplementing the theory by an aspect of causation which goes beyond mere transference and constitutes a link between causation (in the ontological sense) and (what is ordinarily understood by) causal explanation. I propose to analyse this as an aspect of causation in which it is *facts*, not only events, which are causally linked; to distinguish this factual causal link from the link provided by transference between events, I shall call it "causal responsibility".⁴ But first, let us have a look at the "easy" objections which can be solved by (T) itself.

1. Causes as things or events

The first two objections turn around the issue whether the relata of causation are things or events. Both Aronson and Fair take *things* or *objects* to be the relata of causation. In the present context, a thing or concrete physical object is meant to be an entity whose identity conditions can be given in terms of its spatial localisation alone, and which is capable of persisting through time.⁵ In particular, a physical object like a chair or a human individual is *one* object, even when it is considered at different times. A first problem with the hypothesis that the relata of causation are things in this sense, is the following: everyone agrees that causality requires that the cause not be identical with the effect. Thus, if the relata of causation are things, cause and effect must be two different things. But this consequence is incompatible with the fact that there exist causal processes going on within a single thing. A

³I have defended TT against Dowe's and Salmon's process theories in Kistler (1998).

⁴The nature of causal responsibility between facts and its link to causal relations between events are analysed in Kistler (1999) and Kistler (forthcoming).

⁵This is one of the traditional (Aristotelian) criteria for a substance. However, the present discussion is independent of the issues surrounding the concept of substance. In particular, as it will be made clear later (section 2.2.), the concept of something capable of persisting through time is larger than that of a substance: it covers both tropes - particular individual amounts - of conserved quantities and concrete objects, such as a table or a person. Only the latter could claim the title of a substance.

substance's undergoing a chemical transformation which is not due to external influence and the radioactive decomposition of a sample of uranium are clear examples (Cf. Ehring 1986, p. 250; 1997, p. 9). A second problem with taking things as relata is that there are cases of causal interaction which don't involve things in an intuitive sense, e.g. interactions between electromagnetic waves (Cf. Ehring 1986, p. 254).

TT can overcome both of these problems, by switching from things to *events* as the relata of causation. In order to account both for causal processes within a single thing and causation between non-concrete entities (such as electromagnetic waves) events have to be conceived in a neutral and general way as "the content of a space-time-zone" or as "what fills" a space-time-zone. This concept of an event covers waves at a time and a place just as well as things at a time. The hypothesis that the relata of causation are events conceived of as the contents of space-time-zones permits to solve the first problem because one way to conceive of a process occurring within a single enduring object is to say that earlier time stages of the object cause later stages of the same object. But such temporal stages, or "time-slices", of an object are events in the intended sense and thus can be causes and effects. In fact, this conception lays the ground for a causal theory of the persistence of concrete objects through time. To this end, concrete objects may be identified with sequences of events.

In a similar way, the second problem can be overcome by conceiving causal interactions between non-concrete entities like electromagnetic waves as interactions between events.

2. Causation without change, not requiring "causal explanation"

The foregoing reply puts us in a position to counter another of Ehring's objections. As I have noted, our account leads us to consider the mere persistence over time of a concrete object as a causal process, whether or not the object manifests any change in its observable properties. To this consequence, Ehring objects that "certain transferences of energy in this new sense [i.e. without taking objects as the relata⁶; M.K.] do not involve causation. In the case of inertial motion, for example, no causal explanation is required although a quantity of kinetic energy is transported from one point of space to another" (Ehring 1986, p. 254). It must be conceded that the generality of the transference account in terms of events makes it contradict common sense (and most traditional accounts of causation) at this point. However, I think it is in fact a strength of TT to be able to provide a causal underpinning of the persistence of objects through time, and this independently of whether their apparent properties change or not. It is no doubt a result of metaphysical reflection rather than of an analysis of common sense, that the difference between an object which persists without changing and an object that changes is irrelevant from the point of view of the grounds of its

⁶Ehring doesn't consider the hypothesis that the relata of causation might be events. In the quoted passage, he examines the possibility "to define 'transference' more generally as a change in position of a quantity of energy/momentum" (Ehring 1986, p.254).

persistence. But this result could only be used as an argument against the theory if it were clearly counterintuitive which I think it isn't.⁷

3. Simultaneous causation.

Aronson and Ehring take it for granted that there are cases of simultaneous causation where c and e are at some distance from each other. Ehring (1986, pp. 250/1; 1997, p. 9) advances its incapacity to handle simultaneous causation as an argument against TT. Now, it is true that, should there really be simultaneous causation over a distance, TT would be incapable to account for it since there can be no instantaneous transference over some finite distance. Let me be dogmatic on this point⁸: in fact, there is no simultaneous causation in nature. Either the cause is only apparently, but not really, simultaneous to the effect, or the link between the two events is simultaneous but it is not the link between cause and effect, but rather, e.g., between two effects of a common cause.⁹

4. Violation of transitivity.

The following objection (Ehring 1896, p. 256)¹⁰ is more important because overcoming it requires a modification of the formulation of TT given in (T). It requires the introduction of a distinction between events which are directly and indirectly causally related. Consider the situation sketched in Fig. 1.

⁷Ehring has changed his mind on this point. In his (1997) book, persistence (of tropes) without change is considered as the fundamental causal process.

⁸I argue for this thesis in (Kistler, forthcoming).

⁹Another objection to TT which I discuss in Kistler (1998) and which I cannot go into here is that it is said that TT cannot account for the possibility of backwards causation. To account for backwards causation, says Ehring, "would seem to require going beyond an account of causation simply in terms of transference alone" (Ehring 1986, p. 255; cf. Ehring 1997, p. 9). It is true that our thesis (T) expresses a conception of causation as a symmetrical relation. The asymmetry of causation must and can be accounted for by reference to the irreversible character of actual physical processes. It is a contingent fact of the actual world that causation is asymmetrical in it. There are possible worlds in which all causality is symmetrical.

¹⁰Ehring links his discussion of the objection with the fact that individual amounts of CQ lack a sufficiently strong identity through time to track such an amount through a causal chain. This is as much of a problem for his own theory (Ehring 1997), and I agree with his reply: one must distinguish between the epistemological difficulty to track an individual amount of a CQ (or of an individual trope, in Ehring's theory) and the ontological claim that it has a diachronic identity. But I disagree with Ehring in that I do not think this reply to be sufficient. The crucial idea needed to complete the mere recognition of the independence of ontology from epistemology, is the following. If ontology can and should be distinguished from epistemology, it cannot and should not be pursued independently of scientific constraints. Ehring's tropes are too general a concept to be able to be shaped by such constraints. But CQ can. In particular, their identity conditions are such that when two or more quantities of the same CQ are interacting, these amounts have no individual identity which makes them distinct. This fact plays a role in the case discussed in the text two paragraphs later. Cf. Kistler (1998).

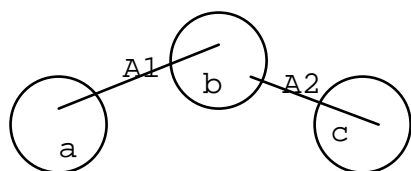


Fig. 1 : Causal chain. a is causally related to b by transmission of $A1$; b is causally related to c by transmission of $A2$.

In a causal chain a - b - c , different individual amounts of CQ are transferred between a and b - let us call this amount $A1$ - and between b and c - let us call this amount $A2$. To make the case as strong as possible, let us assume that the amount $A1$ which is transmitted between a and b , is of a different type of CQ than $A2$ which is transmitted between b and c . In this situation, it is clear that there does not exist a particular amount of a CQ which is present in both a and c . TT therefore predicts wrongly that a and c are not related as cause and effect, whereas the intuition that causation is transitive leads to the result that they are.

However, this problem can be overcome by a rather slight modification of TT, and without abandoning, as Ehring urges, the fundamental idea that both the cause and the effect of a particular causal relation are concrete, i.e. have numerous properties, many of which play no role in that causal relation.

TT can be made compatible with cases of this kind by distinguishing between direct and indirect causation. The original requirement of transmission of an individual amount of a CQ between two events is now taken to apply to direct causation only, while indirect causation between two events requires the existence of a chain of intermediate events, such that each neighbouring pair is directly causally linked.¹¹

In (1997) Ehring directs his argument concerning the transitivity of causation not against transference theory as such, but against the idea that causal relata are concrete. I shall first present one of the cases he presents as counterexamples to any theory of causation with concrete causal relata, and then give a twofold reply. In a first stage, I explain how the concept of indirect causation allows to deny that there is any violation of transitivity, and in a second stage I explain the initial plausibility of Ehring's claim to the contrary, by introducing the notion of causal responsibility.

Ehring's case (cf. fig. 2) contains the following events: d is a chess championship part of which is d_3 , Fred's game; c is a party two of whose parts are c_1 , the toasting of Fred's

¹¹Far from being original, this solution is only the adaptation to TT of David Lewis' (1986, pp. 167, 200) distinction between causal dependence and causation, where causal dependence corresponds to our direct causation, and Lewis' "causation" corresponds to our indirect causation. In Lewis' terminology, we can say that indirect causation is "the ancestral" of direct causation. Lewis' choice of calling "causation" proper only what I call "indirect causation" is that "causation must always be transitive" (1986, p. 167). I think my terminological choice is more intuitive and can nevertheless take account of transitivity: In "causation is transitive", the word "causation" has to be taken in a general sense, to mean "causation, whether direct or indirect". If a and b are causally related whether directly or indirectly, and so are b and c , then the same is true for a and c .

performance, and c_2 , Mark's dancing; e is a medical emergency part of which is e_1 , Mark's having a heart attack.

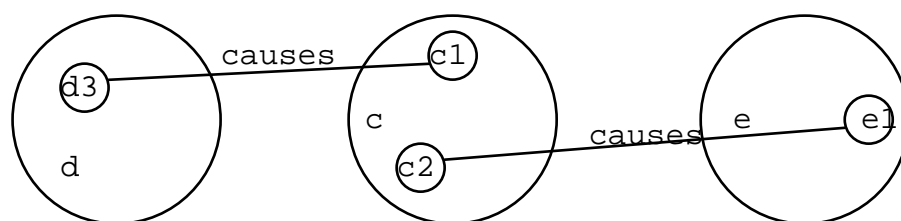


Fig. 2: Causal chain

According to Ehring, this situation constitutes a violation of the transitivity of causation, for d causes c and c causes e , but "the chess championship (d) contributes not at all to the emergency (e)" (Ehring 1997, p. 75). My first reply is to deny the latter claim which Ehring variously expresses later on by saying that these events "are not causally linked" because none of their subevents are so linked (*op. cit.*, p. 75), that the first "is not in any sense a cause" (*op. cit.*, p. 77) of the second, and that the first is "completely irrelevant" for the second, a locution which he later makes more precise by saying that this means "explanatorily irrelevant" (*op. cit.*, p. 77).¹² I take it that it is indeed the issue of explanatory relevance which leads to a satisfactory analysis of the case. d indirectly causes e , or is indirectly causally linked to e . Now, in order to show that this is more than an ad hoc move, let me introduce a distinction between two different questions one may ask of a given causal link. One aims at the ontological notion of causation and the other at the epistemological notion of (causal) explanation.¹³ Ehring proposes an excellent way of expressing this distinction when he says that the "how question" (*op. cit.*, p. 69): "In virtue of which mechanism are c and e causally related?" and the "why question": "In virtue of which properties are c and e causally related?" concerning a given particular causal relation are "independent questions". His own account is meant to be a "mechanistic" theory addressing only the how question and, I would add, the

¹²In fact, Ehring changes his example between pp. 75 and 77, but they are structurally similar, and my point equally applies to both. Ehring (private communication) does not see these statements as giving justifications of the fact that the first event is not a cause of the third which he takes to be "intuitively obvious". He supports it by the observation that these events are not counterfactually linked (although there is no preemption). This argument can be countered by the observation that counterfactual dependence is a reliable guide only to direct but not to indirect causation. Cf. Lewis (1986).

¹³Though Ehring seems in this passage (Ehring 1997, pp. 74-76) to confound them, he is in other places well aware of the distinction between the ontological notion of causation and the epistemological notion of (causal) explanation. Another ambiguity which enhances this confusion can be found in Ehring's thesis that "Causation is *feature-driven* in some sense. Properties must play some role" (*op. cit.*, p. 78). In the next sentence, Ehring characterises this role as an "explanatory role". The confusion between what is ontologically fundamental for causation, and what is explanatorily relevant about the causally related events in terms of their macroscopic properties which are lawfully linked, seems to be the reason why Ehring's persistent tropes may be of any type of properties whatsoever. He appears not to be entirely faithful to his own distinction between the how and the why questions (see below), and to his claim that his account is nonexplanatory and addresses only the how question.

still more general whether question : "Are events c and e causally related?". Ehring explains this distinction in the following passage.

Even if a theory of causation answers the how question, it may not answer the why question, and an answer to the why question does not guarantee an answer to the how question. The why question about direct causation has an answer only if there is generally an explanation for why an event c causes another event e . Whether there will be such an answer depends on whether causal relata exemplify explanatorily relevant properties - on whether, in general, if c causes e there will be properties exemplified by c and e such that those events are causally related in virtue of those properties. Mechanism does not address the issue of whether there is generally this kind of explanation for why c causes e ." (Ehring 1997, p. 69).

In fact, this analysis fits my account better than Ehring's own, for Ehring (1997, chap. 3) denies in general that causes are efficacious in virtue of any of their properties. Ehring argues that no theory can at the same time answer both the how and the why question; his own theory is meant to answer only the how question for it is "mechanistic but nonexplanatory" (*op. cit.*, p. 70). I agree with him that these two questions should be addressed separately. In itself TT also answers only the whether and how questions.

However, contrary to what Ehring holds, answering the whether and the how question is not *absolutely* non-explanatory. Giving a positive reply to the whether question and replying to the how question by indicating a mechanism at work between c and e , is certainly giving *some* kind of explanation of why c causes e . In particular, TT's reply to the how question contains a specification of the type of CQ which is the ground of the causal relation in the case at hand. Nevertheless, I still think that it is reasonable to say that TT doesn't address the why question, and is in this sense "non-explanatory": in the case of causation between macroscopic events which are the usual focus of our interests, our quests for explanation (why?) are formulated in terms of the macroscopic, observable properties of the causally related events. Yet TT has nothing to say about such properties, being formulated exclusively in terms of CQ which are much more general than observable categories.

But nothing stands in the way of supplementing TT so as to take account of the why question: why is it that c causes e - where c and e are known and described on a macroscopic level? In most cases of causal relations we are ever led to examine, it is legitimate to ask for an explanation of why c causes e which goes beyond that given by TT, and which is stated in terms of those macroscopic¹⁴ properties of c and e . TT can indeed be so completed. To this end, I shall propose a general format for expressing the link between what it is about the cause that makes it causally responsible¹⁵ for something.

¹⁴ "Macroscopic" is to be taken in a relative sense : it is intended to refer to properties which are less general than CQ. These properties may still be unobservable without instruments.

¹⁵ The terminological choice to use the expression "causally responsible" isn't supposed to prejudge the analysis of its signification. I take it that it is currently used to express the idea I wish to make precise, e.g. when Armstrong says: "The fire in the hearth is causally responsible for my seeing that there is a fire on the hearth." (Armstrong 1968, p. 230/1).

Let us assume that our causal analysis of a given particular situation has reached the point where we have established *that* c is the cause of e (whether question), and *how* c causes e (how question), namely by having identified the CQ of which a particular amount is transmitted between these events, possibly stepwise if the causal link is indirect. We can address the why question within this framework, on the condition of conceiving of c and e as concrete events - which is the view Ehring seeks to refute with his argument from transitivity. As concrete events, c and e have more than just one property. In particular, they possess properties other than the amount of CQ which links them causally. The why question: "why is c a cause of e ?" can be interpreted as a request for a covering law explanation, with the important qualification that the expected explanation must be embedded in a causal framework. Typically, one wants to know what is causally responsible for the *fact* that a given effect e has some property G , where G is a macroscopic property.¹⁶ This can be done by finding a property F of the cause c , such that a law of nature $L(F,G)$ makes the property G of the effect e dependent on the property F of the cause. I then propose to say that the fact that c possesses F is causally responsible for the fact that e possesses G . The meaning of the statement $R(Fc, Ge)$ to the effect that the fact Fc is *causally responsible* for the fact Ge can then be analysed by the following conjunction: $C(c,e)$ **Erreur ! Source du renvoi introuvable.** $\wedge Fc$ **Erreur ! Source du renvoi introuvable.** $\wedge Ge$ **Erreur ! Source du renvoi introuvable.** $\wedge L(F,G)$. The first conjunct says that c and e are causally linked by transference, the second and third that they exemplify properties F and G which, according to the last conjunct, are linked by a law of nature such that e 's possessing G is due to the instantiation of a law of nature linking properties F and G .

We must be careful not to identify any relations whose existence and nature are the objects of ontological claims, with explanations of phenomena which may include some reference to those relations. Keeping this distinction in mind is especially important (and far from trivial) in the case of the relation of causal responsibility. Although that relation typically constitutes the main target of requests for causal explanation, it should be construed as a relation whose objectivity is independent of the existence of explainers or explanation-seekers. As such it should not be identified with the explanation whose target it is. Let me express the idea behind this distinction in another way. A correct explanation has two sides to it. The first is truth and the second is its pragmatic adequacy given the interests and previous knowledge of the hearer. To count as a good explanation, it is necessary but not sufficient that it be true. The relation of causal responsibility (CR) is meant to be what makes causal explanation true, independently of the epistemological and pragmatic aspects which also enter into its evaluation. In this sense, the analysis of CR falls into ontology as much as thesis (T).

¹⁶In Kistler (1999), I try to show that ordinary speech also gives grounds for making a distinction between causal relations between events and relations of causal responsibility between facts.

With the relation of CR in place, I can make a second attempt to justify my reply to Ehring's case of the chess championship and the medical emergency (Ehring 1997, p. 74ff.). In terms of transference, the chess championship (d) is a cause of the medical emergency (e), at least indirectly, simply because they are linked by an intermediate event c (the party) which is caused by d and is the cause of e . It is of little importance, and of no practical interest, whether d and e are also directly linked. What makes this result so counterintuitive as to lead Ehring to argue that it constitutes a *reductio* of a theory of causation with concrete relata, is the conflation of causality with causal responsibility. The confusion is subtle and important: In this case, there is a positive reply to the whether (and how) question, but no answer is given (nor is it plausibly possible to give one) to the why question. It is crucial to note that the specification of the cause and effect it requires can be accomplished by describing them with the help of any property these events possess and which is sufficiently specific to single them out in the context. In particular, they need not be described by reference to their possession of the determinate CQ which is transmitted between them - although that is necessary to give a precise answer to the how question for that case - but neither need it be by reference to any explanatorily relevant property, where I understand by an "explanatory relevant property" just those lawfully linked properties F and G which appear in the relation of causal responsibility. This is exactly what happens in the chess game/medical emergency case. Here, the events, though indirectly causally linked, not only are not described by reference to properties which are lawfully linked, but (arguably) could not thus be described because they don't possess such properties. This makes them indeed "explanatorily irrelevant" for one another. To give an explanatorily relevant description of the cause and effect is simply something much more demanding than to just designate them in an arbitrary way.

What fails in cases of this type is not really the transitivity of causation between concrete events, but rather *explanatory transitivity*: Suppose that there is a causal chain d - c - e , such that the events d , c , and e are described in such a way that a covering law explanation is available for why d causes c , and a different covering law explanation for why c causes e . This does not imply, and no one would have expected it to imply, that the very same descriptions of d and e can enter in a covering law explanation of why d causes e . The failure of explanatory transitivity between successive links of causal chains comes as no surprise, but it is a fallacy to conclude (as Ehring does) from the failure of explanatory transitivity to the failure of causal transitivity.

It is remarkable that Ehring who repeatedly calls attention to the necessity of distinguishing between ontology and epistemology¹⁷, should fall victim to the fallacy of

¹⁷The distinction is clearly stated when he objects to a rival account by saying that "an ontological notion, 'causal relata', is too closely associated with an epistemological notion - that of explanation" (1997, p. 82). Similarly, "a theory of causal relata should not provide an answer to the question of why c causes e - that is, should reject the assumption that causes must exemplify features which will help explain why they cause the effects they cause" (1997, p. 90). On the distinction between ontology and explanation in the context of causality, see also Aronson (1982).

identifying the causal relatedness of *c* and *e* in an ontological sense, and the causal relevance of the descriptions given of *c* and *e*, in the sense that those descriptions contain a reference to the properties F and G playing a role in the relation of CR. His argument goes like this: There is nothing in the description of *d* as a chess championship and in the description of *e* as a medical emergency which would permit to identify some property of *d* nomically linked to some property of *e*. *Therefore, d and e are not causally linked.* (Then, the argument continues: But transitivity leads to the result that they are causally linked. This contradiction can serve as a *reductio* of one of the premises. As transitivity is unquestionable, Ehring concludes that it is the conception of the events *d, c* and *e* as concrete entities which is refuted.). The fallacy should now be easy to identify: From the premise it is possible to infer that the descriptions of *d* and *e* do not contain reference to any properties F and G which would partake in the relation of CR between the fact that *d* is F and the fact that *e* is G, and which would in this way enable us to explain why *d* caused *e*, what it is about *d* which is causally responsible for its causing the fact that *e* is G. But, in Ehring's own terms, our incapacity to answer the why question doesn't show that there is no answer to the how question.¹⁸ In fact, it doesn't even show that there is no answer to the why question. The fact that we ignore their existence does not show that there objectively exist no such properties F and G which stand, together with their possessor events *d* and *e*, in a CR relation R(Fd, Ge) and thus form a basis for an answer to the why question.

Once we have introduced the notion of causal responsibility, we are able to reply to some other important objections to TT, as I shall briefly try to show now.

5. Interruption

Consider the following statement (1) reporting the interruption of an enduring causal relation.

(1) "A switch is turned off causing the light to go out" (Ehring 1986, p. 251; 1997, p. 9).

Ehring objects that TT wrongly predicts that some amount of a CQ is transferred from the cause, the turning of the switch, to the effect which he takes to be the light's going out. The prediction is wrong because, he says, "there is no transference of a quantity from the switch to the light" (Ehring 1986, p. 251). This seems to be a bad way of formulating the objection for if the effect is taken to be the light's going out, one should not blame TT for the fact that there is no transference to *the light* which is very different from the event of the light's *going out*. But let us restate the objection: TT must be wrong because nothing is (and

¹⁸Our analysis does not vindicate Ehring's remark made in a footnote that "causal transitivity dictates that there is no explanation for why causes bring about their (direct) effect" (p. 169, note 12). What we found is rather that causal transitivity should not be expected to be always paralleled by transitivity of the corresponding causal explanations.

presumably even could be) transferred to the event of the light's going out and the subsequent state of the light's being out, a state negatively characterised by the absence of light.

I shall try to show that TT can handle cases as this. The crucial point is that (1) delivers a complex piece of information which is causal only in part. (1) makes reference to a causal relation t , but it explicitly designates only its cause event c which is the turning of the switch.

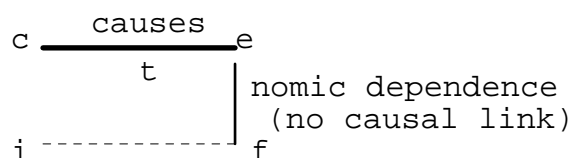


Fig. 3: Interruption

c : turning of the switch

e : opening of the electrical circuit

i : initial state : light on

f : final state : light out

However, it designates neither the effect event e which is the final point of t nor a relevant fact implying this event. Instead, it designates a state f (the light's being out) which is negatively characterised as a consequence of t . One can deduce from the nature of the physical process underlying what is stated in (1) that the end point of the causal process launched by c is the opening e of the electrical circuit including the light source, or some equivalent event. Instead of directly stating e , (1) rather expresses one of its results, f . f is a nomic, but not causal, consequence of e , and thus of t . f 's nomic dependence on e can be expressed by saying: state f is present because e has occurred. In this statement, the word "because" does not have a causal, but a more general explanatory sense. It is backed by a lawful dependence which might be expressed by saying: If the circuit linking a light source to the source of electric energy is interrupted, no current flows and no light is emitted. Indeed, there could be no cause of f , for f is the negative state of the absence of light. No causal account of the absence of anything is needed, nor is it possible. The absence can be explained, but not by indicating its cause.

In fact the situation is still more complex because f is not designated in a purely negative way. Rather, (1) says, that t makes the light "go out", that is to say provoked a transition between an initial state i where there has been light, to f .

The difficulty in giving a causal analysis of statement (1) lies in the fact that t , the causal relation expressed, is not a relation linking i to f . It is just that the result e of t is such as to make impossible the causal relations underlying the state i , namely the flow of electrons through a wire. Now someone might be prepared to accept the idea that the relation between e and f is not causal because nothing can cause the absence of something, but still ask whether i might not somehow be implied in the causal process designated by (1). The answer is again, no: i is a stable state consisting of the permanent flow of electrons through a wire and a light

t itself is clearly causal and compatible with TT: the releasing of the catch is a causal process. The difference with the interruption case lies in the characteristics of i and f : now i is the stable situation characterised by the absence of movement, whereas f is in itself a causal process, consisting in the transformation of the potential energy stocked in the compressed spring in kinetic energy, itself transferred to the weight it moves by contact. Once more, (2) should be considered as giving an explanation of why the stable state i gives way to state f which contains a dynamic process. Once more it accomplishes this by referring to a causal relation t . However, contrary to what we would expect from a straightforward causal statement, (2) does not designate directly a cause and an effect, as could be the end points of t . Rather it designates the end point of t - the catch's getting released - and the state f - the process of the expansion of the spring.

A potentially misleading aspect of the situation is the fact that f consists itself in a causal process, but that *its* cause in general doesn't even contain the effect event of the triggering relation t as one of its parts.²⁰ The relation between the effect of t - the removal of the catch - and the causal process f is one of nomic dependence, but not itself causal. The absence of the catch is a negative condition which makes it possible for the cause of f to act. But it is not even part of the cause because an absence cannot be a cause any more than it can be an effect. (The latter fact is relevant in cases of interruption which have been discussed before.)

According to Ehring and Krajewski (1997), TT wrongly predicts in a case like (2) that the energy - or an amount of some other CQ - which is found at the end point of the *triggered* process f , must have been transmitted from the initial point of the *triggering* process t . This is clearly not the case, but neither is it the case that TT has to predict this. To explain why requires acknowledging that these are indeed two different causal processes. TT can easily account for each of them taken in itself, the difficulty lying in the analysis of their link. The objection can be overcome by pointing out that the link between the effect of the triggering process t and the cause of the triggered process f is nomic but not causal.²¹

7. Informational causes

Let me end by asking whether TT can acknowledge Krajewski's (1982, p. 225; 1997, pp. 195ff.) claim that there are "informational causes".²² According to this author, the "transmission of information" provides a grounding of the relation of causation independent

²⁰Krajewski (1997, p. 195) describes a case of an electrically triggered explosion. This may be a case in which the effect of the triggering is part of the cause of the explosion in the sense of TT, although, as Krajewski makes clear, a part whose quantitative contribution to the cause of the explosion is negligibly small.

²¹In other situations, like in Krajewski's case of an explosion (cf. preceding footnote), that link may be causal in addition.

²²A similar question is whether the "information transmission" mentioned by Salmon (1984, p. 156; cf. also Salmon 1994, p. 303) is a transference in the sense of TT.

of the transmission of energy. In (Krajewski 1997), he takes care to note that this is only an independence "in principle". In effect he vindicates the central thesis of TT when he says that "in all six kinds of CC [Causal Connection] there is a flow of energy. It seems that causation without such flow is impossible. However, for some kinds of C (trigger C, information C), the amount of this energy is inessential, it may be very small" (1997, p. 199).²³

Our account allows to clarify the role Krajewski attributes to information. To take one of his own examples, "the cause of an infectious disease is the penetration of bacteria or viruses into the organism. As we have noticed, it is not an energetic cause of the disease. It is a triggering cause but at the same time an informational cause because it brings information on the structure of pathological changes in the tissues of the organism." (Krajewski 1997, p. 196). To express what Krajewski means by saying that this is not an energetic cause, in the terminology of the preceding section: The energy deployed in the result of the triggered process (or at least the major part of it), i.e. the disease, is not transmitted from the triggering process. His reason for saying that it is an informational cause instead is that what is crucial in the process of the infection, is not the amount of energy carried by the bacteria into the host organism, but the structural information it carries about the disease. This structural information would also constitute the primary target of a causal explanation of the disease in a particular individual.

Our account enables us to describe the case in the following way. The bacteria's arrival in the victim's organism is a cause of the subsequent evolution of the disease, and this causal relation is covered by TT. But what is more interesting for us, is what is *causally responsible* for the fact that the individual contracted this disease at that moment. We can then identify the fact that the bacteria are of a certain pathogenic type, as the causally responsible fact, which, it seems to me, captures Krajewski's intuition. Nevertheless, this analysis allows us to escape the erroneous impression that information as such might be carrying causation, in the same way as amounts of CQ can. This is clearly wrong for the simple reason that information is not a CQ in the physical sense, and thus cannot be transmitted in the material sense required by the TT.²⁴ Information is no intrinsic property of physical processes, but is well determined only within the background of a reference frame which is fixed by the observer. To show that the relation of carrying information is not sufficient for causation, consider two effects of a common cause, e.g. the receiving of a radio signal by two distant receivers. The receivers are informationally related but need not be causally related.²⁵

²³It seems clear that he rejects the generalisation from energy to other CQ. Thus, he explicitly says of momentum transfer that "it is always connected with the transfer of energy" and that for this reason he sees "no reason to speak about the transfer of momentum as a special kind of CC." (Krajewski 1997, p. 195).

²⁴I briefly address this issue in Kistler (1998, p. 21, note 20).

²⁵I think that many objections to TT can be countered by analyses similar to those of the preceding problem cases. This is the case, e.g. with a situation imagined by Fair (1979, p. 238) and developed by Ehring (1986, pp. 254/5) where an event *e* is caused by waves on a pond which are excited by several sources, such that the origin of the energy present in the event *e* is, according to Ehring, indeterminate. Ehring argues that this shows the

Conclusion

Transference theory is controversial. I have here tried to answer some objections that have been put forward against Aronson's and Fair's earlier versions. If my attempts have been successful, the theory comes out strengthened from this confrontation for the problematic cases we have considered are so many constraints which sharpen our understanding of the concepts needed to make the account viable. We have been led to make some important adjustments to the theory. In particular, we have introduced a distinction between causation linking events and causal responsibility linking facts. The latter relation is stronger: the causal chains we have examined show that only the eventual causal relation based on transmission, but not the relation of causal responsibility is transitive. Our problem cases are compatible with the thesis that the failure of the transitivity of causation is due to the non-transitivity of causal responsibility. However, the distinction between causation and causal responsibility is not an ad hoc move to overcome some counterexamples. It is independently motivated by the need to close the gap between the transference account which is formulated in physical terms and common or scientific causal explanations which need not invoke physical vocabulary. Transference though being fundamental is too general to be able to provide satisfying responses to all questions as to *why* a given cause acts as it does. Causal responsibility is conceived as the relation between what is it about the cause that makes it cause the effect. It is the immediate object of a causal explanation.

The modified transference theory has interesting consequences. In particular, we have seen that triggering and interruption have to be analysed in a causal and a non-causal component which is lawful dependence. In the case of the turning out of the light, we have come to the conclusion that the light's going out is not caused but only conditioned by the flipping of the light switch. The light's going out is the transition of a causal process - the emission of light from the wire - to the absence of that causal process, and that transition is not an effect any more than the subsequent absence of light. It is just lawfully dependent on the condition of the electrical circuit.

The very generality of the intended concept of causation, allowing it to cover causation between different material objects, between non-material objects such as fields, and between different temporal stages of one object has led us to conceive the relata of causation as the particular content of a space-time zone. This has the controversial, but in my view in the end fruitful and plausible consequence that causes and effects need not be changes, at least not at every level on which they can be described. A stable state such as that of a bridge may be the cause of the stable position of someone standing on it. There will be microscopical changes

inadequacy of TT because it is bound to conclude that *e* has no determinate cause. I analyse this case in (Kistler, forthcoming).

consisting in the exchange of particles, but in virtue of the absence of observable changes, traditional accounts of causation could not account for these states being causally linked, because they exclude stable states from possible causes or effects. Related to this, another important result is that our version of transference theory allows us to conceive of the persistence of material objects through time as of a causal process, independently of whether the objects change or not.²⁶

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