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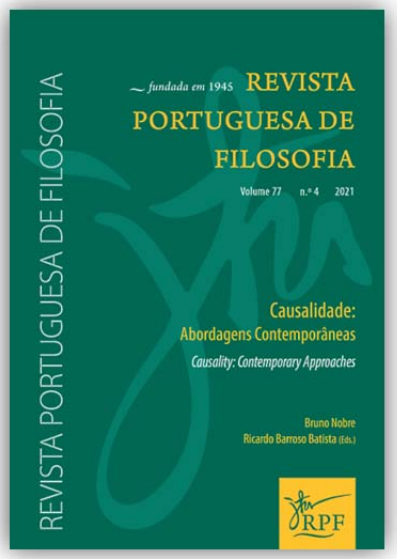

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Causal Predicates, Causal Principles, and the Core of Causation

UWE MEIXNER*

Abstract

How might one tackle the subject of causation with the least amount of preformed conceptions – and arrive by a series of well-motivated conceptual decisions at a concept of causation that captures the "heart of the matter"? This essay is a sustained attempt to answer this question. On the way, causal predicates of various degrees of importance are defined and causal principles of various degrees of plausibility discussed, all of this in the service of approaching, step by step, "the heart of the matter."

Keywords: agent, event, first cause, making actual, overdetermination, rationality, sufficient cause, temporal order.

How might one tackle the subject of causation with the least amount of preformed conceptions – and arrive by a series of well-motivated conceptual decisions at a concept of causation that captures the "heart of the matter"? This essay is a sustained attempt to answer this question. On the way, causal predicates of various degrees of importance are defined and causal principles of various degrees of plausibility discussed, all of this in the service of approaching, step by step, "the heart of the matter."[1]

1. The first step of analysis: the fundamental causal predicates

Consider the two-place predicate "x is a causal factor for y," in symbols: CFxy. The work of conceptual distinction and of the formulation of prin-

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1. Causality is, of course, a very complex subject. In this essay, while pursuing my own line of thought, I do mention the opinions of others in a general manner – if it fits the context – and react to them, likewise, in a general manner. Anything more than this would not have been compatible with the goal I set myself for this essay – simply for considerations of space. For a reliable comprehensive, detailed, and fully referenced discussion of causal ideas, contemporary or historical, and of many issues raised in this essay, see for example: Uwe Meixner, *Theorie der Kausalität. Ein Leitfaden zum Kausalbegriff in zwei Teilen* (Paderborn: Mentis, 2001).

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ciples starts with this predicate and two modifications of it: "x is a sufficient causal factor for y," in symbols: SCFxy; "x is a required[2] causal factor for y," in symbols: RCFxy. The logical relationship between these three basic predicates is regulated by the following conceptually true principle (in order to make logical structures apparent, I use the familiar symbolism of elementary predicate logic):

P1 $\forall x \forall y(SCFxy \vee RCFxy \supset CFxy)$.

The converse of P1 is neither conceptually true nor true at all: a causal factor for something is often neither sufficient nor required for it, but only contributing to it. Moreover, a sufficient causal factor for something is sometimes not required for it, and a required causal factor for something is sometimes not sufficient for it. It happens, however, that a causal factor for something is both sufficient *and* required for it. Thus, we have the following four factual truths (none of which is a conceptual truth):

F1 $\exists x \exists y(CFxy \wedge \neg SCFxy \wedge \neg RCFxy)$.

F2 $\exists x \exists y(SCFxy \wedge \neg RCFxy)$.

F3 $\exists x \exists y(RCFxy \wedge \neg SCFxy)$.

F4 $\exists x \exists y(SCFxy \wedge RCFxy)$.

Given the three basic causal predicates just introduced, the following causal predicates can be defined:

D1 $CCFxy =_{Def} CFxy \wedge \neg SCFxy \wedge \neg RCFxy$. ["x is a *(merely) contributing causal factor* for y if, and only if, x is a causal factor for y which is neither sufficient nor required for y"].

D2 $ACxy =_{Def} SCFxy \vee RCFxy$ ["x is *a cause* of y if, and only if, x is a sufficient or a required causal factor for y"].

D3 $Cxy =_{Def} SCFxy$ ["x *causes* y if, and only if, x is a sufficient causal factor for y"].

D4 $PACxy =_{Def} RCFxy \wedge SCFxy$ ["x is *a perfect cause* – is *perfect as a cause* – of y if, and only if, x is a required and sufficient causal factor for y"].

2. The word "required" is here being preferred to the usual "necessary" because "necessary" in "x is a necessary causal factor for y" suggests – contrary to what is intended – that the causal factor itself exists necessarily. What is intended with "x is a necessary causal factor for y" is, of course, only this: x is a causal *conditio sine qua non* for y – or in other words: x is a *required* causal factor for y.

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From these definitions, it can be immediately seen that the following conceptual relationships hold between the four defined predicates:

$$PACxy \rightarrow Cxy \rightarrow ACxy \rightarrow \neg CCFxy$$

The arrow stands for (broadly logical) entailment (which is a transitive relation). The inverses of the depicted relationships of entailment do not hold true (in view of F1 – F3). Moreover, we have:

$$PACxy \rightarrow Cxy \rightarrow \mathbf{ACxy} \leftrightarrow \mathbf{SCFxy} \vee \mathbf{RCFxy} \rightarrow CFxy$$

$$PACxy \rightarrow \mathbf{Cxy} \leftrightarrow \mathbf{SCFxy} \rightarrow CFxy$$

$$\mathbf{PACxy} \leftrightarrow \mathbf{SCFxy} \wedge \mathbf{RCFxy} \rightarrow CFxy$$

The analysis offered so far reflects the truth that, beside the distinction between *being a causal factor* and *being a cause*, there is the no less important distinction between *being a cause* and *causing*. Everyday language tends to obscure this truth, since "x is a cause of y" is used by many people *both* in cases where they want to say that x causes y, *and* in cases where they only want to say that x is a required causal factor for y – and, indeed, by some people even in cases where all they want to say is that x is a contributing causal factor for y.[3] Less frequently, but often still, one also encounters the use of "x causes y" where all that is intended is that x is a required causal factor for y, or even merely that x is a contributing causal factor for y. An indication, however, that *being a cause* and *causing* are different concepts – just in case further evidence is needed – is the fact that the most fitting way to define "y is an effect of x," in symbols: FFyx, is *not* via using "x is a cause of y" as definiens (let alone via using "x is a causal factor for y" as definiens); rather, the most fitting way – not to say the *only* fitting way – to define that predicate is this:

D5 $FFyx =_{Def} Cxy$ ["y is an *effect* of x if, and only if, x causes y (or in other words: y is *effected* by x)"].

It should, finally, be noted that "x causes y" [Cxy] and "x is a sufficient cause of y" [ACxy ∧ SCFxy] are logically equivalent, just as are "x causes y" and "x is a sufficient causal factor for y" [SCFxy]. Both logical equiva-

3. Philosophical analysis should not identify concepts which are distinct. (Needless to say.) Note that the mistake of the identification of distinct concepts is most often committed quite without any act of explicit identification: it is most often committed by simply *ignoring* the concepts that are similar to, yet distinct from the concept one happens to focus on.

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lences are trivial consequence of the definitions. I shall, therefore, treat the three predicates as synonyms.

2. The second step of analysis: moving sufficient causation into focus

For what follows in this section, the predicate of parthood is needed: "x is a part of y" [Pxy], which is to be taken in a sense that is appropriate for causal analysis.

D6 $MCxy =_{Def} Cxy \wedge \neg\exists z(Pzx \wedge z{\neq}x \wedge Czy)$ ["x is a *minimally sufficient cause* of y if, and only if, x causes y and there is no proper part of x which causes y"].

It can immediately be made evident what the predicate introduced by D6 is good for. It does not follow from "there is more than one cause of y" [$\exists x\exists z(x{\neq}z \wedge ACxy \wedge ACzy)$] or even from "more than one entity causes y" [$\exists x\exists z(x{\neq}z \wedge Cxy \wedge Czy)$] that y is *causally overdetermined*. Causal overdetermination is often considered to be something "weird" (to put the matter very briefly), and not infrequently as something that "shouldn't be"; but there is nothing in itself weird about $\exists x\exists z(x{\neq}z \wedge ACxy \wedge ACzy)$ or $\exists x\exists z(x{\neq}z \wedge Cxy \wedge Czy)$; *or* about there being more than one *required* causal factor for y [that is, $\exists x\exists z(x{\neq}z \wedge RCFxy \wedge RCFzy)$, which logically implies $\exists x\exists z(x{\neq}z \wedge ACxy \wedge ACzy)$]; *or*, indeed, in the situation that, with some x being a sufficient causal factor for y, also some z, of which x is a proper part, is a sufficient causal factor for y [that is, $\exists x\exists z(Pxz \wedge x{\neq}z \wedge SCFxy \wedge SCFzy)$, which logically implies $\exists x\exists z(x{\neq}z \wedge Cxy \wedge Czy)$]. Moreover, there is nothing in itself "weird" in the situation that with some x being a sufficient causal factor for y, and some z – different from x – being a sufficient causal factor *for* x, z, too, is a sufficient causal factor for y [that is, $\exists x\exists z(SCFzx \wedge x{\neq}z \wedge SCFxy \wedge SCFzy)$]; this situation is simply a consequence of the transitivity of SCF. However, the "weirdness" causal overdetermination has (in the eyes of many philosophers) is very well captured if the following definition of it is adopted:

D7 $CODy =_{Def} \exists x\exists z(x{\neq}z \wedge \neg Cxz \wedge \neg Czx \wedge MCxy \wedge MCzy)$ ["y is *causally overdetermined* if, and only if, there are at least two minimally sufficient causes of y, neither of which causes the other"].

Many philosophers believe that causal overdetermination is so "weird" that it *ought* to be excluded: "Why two minimally sufficient causes neither of which causes the other if *one* is quite enough? Ockham's Razor requires … [and so on]." However, in pure causation theory we are not in the realm

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of "ought" and "ought not," but entirely in the realm of "is" and "is not," and it seems clear that, in the realm of "is" and "is not," causal overdetermination is certainly not logically (conceptually) excluded. But *perhaps* – we cannot be quite sure – it is *factually* excluded:

?F1 $\neg\exists y\mathrm{CO}Dy$ [in other words: $\forall y\forall x\forall z(\mathrm{MC}xy \wedge \mathrm{MC}zy \wedge \neg\mathrm{C}xz \wedge \neg\mathrm{C}zx \supset x{=}z)$].

?F1 is a rather "tentative fact" indeed. But even more doubtful is the following "fact" (of which ?F1 is a logical consequence):

??F2 $\forall y\forall x\forall z(\mathrm{MC}xy \wedge \mathrm{MC}zy \supset x{=}z)$.

According to ??F2, everything has *at most one* minimally sufficient cause (that is, no such cause, or exactly one such cause).

It is quite another question whether everything has *at least one* minimally sufficient cause. The answer is this: Since for some entities there is not even a causal factor – for example, for the proposition that 2+2=4, or for the set of natural numbers – it follows logically (according to P1 and the definitions) that some entities have neither a sufficient nor a required causal factor, and that, therefore, they have no cause and are not caused (are not effected, are not effects), and, a fortiori, that they have *no* minimally sufficient cause. We retain as a conceptual truth:

P2 $\exists y\neg\exists x\mathrm{CF}xy$.

The matching $\exists y\exists x\mathrm{CF}xy$ – which is the negation of *radical causal nihilism* – is already entailed by any of the factual truths F1 – F4 presented in Section 1. Let it, too, be "canonized":

F0 $\exists y\exists x\mathrm{CF}xy$.

If one insisted on being skeptical (it is not entirely unreasonable to do so), one might insist that not only ?F1 and ??F2, *but also* F0 and, therefore, F1 – F4 are *doubtful*, and that one should refrain from assuming even F0.[4] One reason (not the only reason) I do not follow this advice is that, if I did follow it, this essay would have to stop right here.

P2, too, is not free from skeptical attack, for the following reason: Does it not presuppose that there are abstract entities and that abstract entities have no truck with causation? But nothing much depends on P2;

4. A curious advantage of assuming the negation of F0 is that ?F1 and ??F2 turn out to be trivially true.

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so let it be granted. A much more serious matter than P2 is the assertion ∀y¬∃xSCFxy, or in other words (in view of D3): ∀y¬∃xCxy – "Nothing is caused / Nothing has a sufficient cause," which not a few people believe to be true while they are at the same time upholding the truth of ∃y∃xRCFxy ["For something there is a required causal factor"], hence (in view of D2) the truth of ∃y∃xACxy ["Something has a cause"], and, normally, also the truth of ∃y∃xCCFxy ["For something there is a (merely) contributing causal factor"]. For the less radical – "milder" – sort of causal nihilism expressed by ∀y¬∃xSCFxy / ∀y¬∃xCxy (and *not* expressed by ∀y¬∃xCFxy, the negation of F0) they argue as follows: Either there is a causal factor for y or there is none; if there is no causal factor for y, then, a fortiori, there is no sufficient causal factor for y, hence no sufficient cause of y, and y is not caused; if, however, there is some causal factor for y, then, nevertheless, *quantum physics* shows that there is no *sufficient* causal factor for y, hence no sufficient cause of y – and, again, y is not caused.

In response the following can be brought forward: Even with regard to the entities that quantum physics specifically addresses: microphysical events, for each of which there is, no doubt, a causal factor (as is shown by the relevant statistics) – even with regard to these events it is *rather dubious* that quantum physics actually shows that they have no sufficient cause, that they are, in other words, uncaused, hence "due to" (objective, ontological) *chance* (big chance or small chance, but in any case *chance*). What can be upheld with reasonable certainty is merely this: quantum physics shows that those events have no *physical* sufficient cause.

Practically for the entire time of the existence of philosophy until the beginning of the 20th century, its practitioners – with few exceptions – maintained the *Principle of Sufficient Cause*, which, put in its most general defensible form, is this:

?F3 ∀y(∃xCFxy ⊃ ∃zCzy) ["Everything for which there is a causal factor has a sufficient cause"].

Accordingly (that is, if this principle is true), "chance does not have a chance" (one might quip), and a certain kind of *irrationality in explanation* does not have a chance. (Usually, the Principle of Sufficient Cause was asserted as logically implied by the *Principle of Sufficient Reason*: qua part of the content of the latter.[5]) Given F0, which is the negation of *radical*

5. The Principle of Sufficient Cause and the Principle of Sufficient Reason are not identical: In addition to its causal content, represented by the Principle of Sufficient Cause, the Principle of Sufficient Reason also has *teleological* content, involving

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causal nihilism, an immediate consequence of the Principle of Sufficient Cause is ∃y∃zCzy, which is the negation of *simple* causal nihilism (the "milder" sort of causal nihilism already mentioned) and logically stronger than F0. But, unfortunately, a question mark needs to be put to the Principle of Sufficient Cause (and therefore, instead of being labeled "F5," it turns out to be labeled "?F3"). For the advent of quantum physics *did* bring about a change in the epistemic status of the principle. Quantum physics did not refute the Principle of Sufficient Cause, but it certainly cast doubt on it: As was, in effect, already stated above, it can be upheld that quantum physics shows that *some physical events for which there is a causal factor have no physical sufficient cause*. This can be taken to be another factual causal truth, and I, for my part, do take it thus. I therefore put it down as a further factual causal truth:

F5 $\exists y(\Phi y \wedge EVy \wedge \exists xCFxy \wedge \neg\exists z(\Phi z \wedge Czy))$.

Now, for some people (for the majority, in fact), F5 even amounts to a *refutation* of the Principle of Sufficient Cause. How, in the name of logic, can this be?

Thus: They believe in the *Weak Principle of Causal Closure* (*of the Physical*), or even in the *Strong Principle of Causal Closure*:

?F4 $\forall y(\Phi y \wedge EVy \wedge \exists zCzy^{6} \supset \exists z(\Phi z \wedge Czy))$ ["Every physical event which has a sufficient cause also has a sufficient physical cause"].

?F5 $\forall x\forall y(\Phi y \wedge EVy \wedge Cxy \supset \Phi x)$ ["Every sufficient cause of a physical event is itself physical"].

It is easily seen that ?F5 (the Strong Closure Principle) logically implies ?F4 (the Weak Closure Principle), and that ?F4 (and a fortiori ?F5) in conjunction with F5 logically implies $\exists y(\Phi y \wedge EVy \wedge \exists xCFxy \wedge \neg\exists zCzy)$ – which obviously contradicts ?F3. However, faced with F5, one may very well choose *to stick with* ?F3; after all, its rationality clearly surpasses both the rationality of ?F5 and of ?F4, which depend rather heavily on the plausibility of *materialism* whereas ?F3 is, in itself, *metaphysically neutral*. Indeed, if causal overdetermination is supposed to be "weird" – that is,

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meanings: aims, goals, purposes, intentions. If something has a sufficient reason, then it also has a sufficient cause; for a *sufficient* reason is not inefficacious: it is a *meaning-directed* sufficient cause.

6. The connective $\wedge$ and also the connectives $\neg$ and $\vee$ bind more strongly than $\supset$; this convention saves brackets. Note also that $\neg$, in turn, binds more strongly than $\wedge$ and $\vee$, and that $\wedge$ binds more strongly than $\vee$.

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irrational – then what about (objective, ontological) *chance* as manifested in entities for which (contradicting ?F3) there is a causal factor, but *no sufficient* causal factor; which entities, therefore, are inexplicable in their actuality? Is this not even "weirder," even more irrational than causal overdetermination?

It is easily seen that ?F3 is, in fact, logically consistent with F5. In conjunction with F5, ?F3 does not entail a logical contradiction; what follows from the conjunction is merely this: $\exists y(\Phi y \wedge EVy \wedge \exists xCFxy \wedge \neg\exists z(\Phi z \wedge Czy) \wedge \exists z(\neg\Phi z \wedge Czy))$ ["Some physical event for which there is a causal factor has no physical sufficient cause, but does have a *non-physical* sufficient cause"] – which obviously contradicts both ?F4 and ?F5.

What is, philosophically speaking, the best way to react to this dilemmatic situation? F5, ?F3, ?F5 is a logically inconsistent triple, and so is F5, ?F3, ?F4. Having accepted F5, one cannot, in reason, also accept ?F3 *and* ?F4, let alone ?F3 *and* ?F5, not even as pairs of doubtful ?-principles (but note: *taken by themselves*, neither ?F3 and ?F4, nor ?F3 and ?F5, logically contradict each other). One can let oneself be guided by one's metaphysical preference for materialism; this means that one will retain ?F5, or at least ?F4, and reject ?F3. *Or* one can let oneself be guided by one's preference for rationality; this means that one will retain ?F3 and reject both ?F4 and ?F5. If this description of what is at issue seems "loaded" (by a preference for immaterialism), it nevertheless remains true that one has to make a *choice* here (as long as one sticks to F5 and, moreover, does not opt for the supererogatory "Solomonic solution" of rejecting both ?F3 and ?F4, and hence also ?F5). My own choice is to retain ?F3, and to reject ?F4 and ?F5. But ?F3 – the Principle of Sufficient Cause – remains *doubtful* nonetheless. I shall not make any use of it in this essay.

However, it seems safe to assume the negation of *simple* causal nihilism – even without the support provided by the Principle of Sufficient Cause, and even in the presence of quantum physics:

F6 $\exists y\exists zCzy$ ["Something causes something"].

(F0 – the negation of *radical* causal nihilism – is a logical consequence of F6, given P1 and the definition of Czy.) The (assumed) truth of F6 is motivation enough further to explore the causal predicate Czy ["z causes y," "z is a sufficient cause of y," "z effects y"]. The core – the heart – of causation lies with this predicate; for causation should provide *explanation*, and if y is to be *explained*, then only the predicate "z causes y" [Czy], if *truthfully* applied to z and y (if *fulfilled* by z and y), provides a satisfactory answer, and *not* already – *not* already by itself – "z is a causal factor for y" or "z is a

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cause of y" (let alone "z is a contributing causal factor for y"), even if these predicates are truthfully applied to z and y.

Nevertheless, if Czy were an empty predicate, or were likely to be empty, then, of course, there would be no point in going any further with it, and then other causal predicates would have to move into the focus of attention. In fact, this is what *did* happen in recent decades: causal predicates other than Czy moved into the focus of attention. Within the last fifty years, the greater part of the philosophical work in the theory of causality was done within the framework of probabilistic and counterfactual *sine-qua-non* conceptions of causality. Probabilistic theories of causality center, in effect, on the causal predicate CFzy, and mainly on CCFzy; *sine-qua-non* theories of causality (with counterfactual conditionals, or without) center on the causal predicate RCFzy, and mainly on RCFzy $\wedge$ $\neg$SCFzy. These theories are, no doubt, theories of *causality* (and a huge amount of good work was and is being done in them), but they are not theories of *causation* (properly speaking).[7] For causation is – in the first place, and neither marginally nor negligibly – *sufficient* causation. (In fact, it can seem that adding "sufficient" to "causation" is like adding "three-cornered" to "triangle.")

But are there good reasons for assuming F6? If one does not expect too much from a sufficient cause (for example, that it causes its effect with a sufficiency that is *absolute* in every respect), *or* if, alternatively, one believes in God and his absolute power to create; then there is no reason to doubt the truth of F6. For there are countless everyday examples of causal factors which are "sufficient enough" for quite a lot of things (every firing of a gun is an example). And if one believes in God and his absolute power to create, then even one's craving for *absolute* sufficiency (or: absolute *efficacy*) in causation is satisfied. However, the God-hypothesis is not needed: everyday life – even if God did not exist – is quite sufficient to convince one of the truth of F6.

3. The third step of analysis: yet further causal predicates and principles connected with sufficient causation

The analysis of causation presented in this essay centers on the predicate Czy. This much is clear by now. But, so far, no analysis has been applied to the *(conceptual) content* of Czy, the content of "z causes y," focussing on

7. For a comprehensive, detailed, and fully referenced discussion of those theories, see Meixner, *Theorie der Kausalität*.

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its *core-content*, which at the same time is *the core of causation*. This step will be made in the Section 5 of this essay. In this section, however, there is yet more of the kind of disquisition which filled Section 2.

Here are the definitions of causal predicates which, historically, played a rather important role, but which nowadays seem to have fallen quite into oblivion:

D8 $1.Cxy =_{Def} Cxy \wedge \neg\exists zCzx$ ["x first-causes y"; "x is a first sufficient cause of y"].

D9 $1.!Cxy =_{Def} Cxy \wedge \neg\exists zCFzx$ ["x *radically* first-causes y"; "x is a *radically* first sufficient cause of y"].

D10 $1Cxy =_{Def} Cxy \wedge \neg\exists z(z{\neq}x \wedge Czy)$ ["x solo-causes y"; "x is a sole sufficient cause of y"]

D11 $1!Cxy =_{Def} Cxy \wedge \neg\exists z(z{\neq}x \wedge CFzy)$ ["x *radically* solo-causes y"; "x is a *radically* sole sufficient cause of y"].

These four predicates serve to describe causal situations that are, normally, considered to be far from normal and quite exceptional. Before going into this, it is the right place and time formally to introduce the following conceptually true principles (the first one was made use of once already) for one of the fundamental causal predicates, SCFxy, and thereby (because of D3 and D5) for Cxy and FFyx:

P3 $\forall x\forall y\forall z(SCFxy \wedge SCFyz \supset SCFxz)$ [the transitivity of SCF].

P4 $\forall x\neg SCFxx$ [the irreflexivity of SCF].

Transitivity and irreflexivity are conceptually required not only for SCFxy, but also for RCFxy and CFxy. No use will be made of the transitivity and irreflexivity of RCFxy in this essay, but use will be made of the transitivity and irreflexivity of CFxy. I, therefore, add the following conceptually true principles to the list:

P5 $\forall x\forall y\forall z(CFxy \wedge CFyz \supset CFxz)$ [the transitivity of CF].

P6 $\forall x\neg CFxx$ [the irreflexivity of CF].[8]

Question: For what reason is irreflexivity a conceptual requirement for CFxy, hence (in view of P1) also for RCFxy and SCFxy? *Answer*: That x is a causal factor for y means that x gives to y at least a portion of *something*[9]

8. In view of P1, P4 is a straightforward consequence of P6.
9. See Section 5 for an answer to the question of what this *something* is.

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which y, so far, does not have a portion of; hence: that x is a causal factor *for itself* means that x gives *to itself* at least a portion of what x, so far, does not have a portion of. *But nothing can give what it does not already have*.

Obviously (in view of D3 and P1), 1.!Cxy entails 1.Cxy, and 1!Cxy entails 1Cxy. And here are two theorems that, with the help of P3 and P4, respectively, P5 and P6, further characterize the above four newly defined predicates:

T1 $\forall x \forall y(\neg 1.Cxy \supset \neg 1Cxy)$ ["For any x and y: if x does not first-cause y, then x does not solo-cause y"].

Proof: Suppose x does not first-cause y, hence (because of D8): either x does not cause y, or x causes y and some z causes x. In the first case, x does not solo-cause y (according to D10). In the second case, z – in causing x – must be different from x (because of D3, P4), and must, in addition to x, cause y (because of D3, P3), since x causes y; therefore, also in the second case x does not solo-cause y (see D10). This is all that is needed for proving T1.

T2 $\forall x \forall y(\neg 1.!Cxy \supset \neg 1!Cxy)$ ["For any x and y: if x does not *radically* first-cause y, then x does not *radically* solo-cause y"].

Proof: Suppose x does not radically first-cause y, hence (because of D9): either x does not cause y, or x causes y and there is a causal factor z for x. In the first case, x does not radically solo-cause y (according to D11). In the second case, z – in being a causal factor for x – must be different from x (because of P6), and must, in addition to x, be a causal factor for y (because of P5), since x causes y and hence is a causal factor for y (due to D3, P1); therefore, also in the second case x does not radically solo-cause y (see D11). This is all that is needed for proving T2.

Now, together with the Principle of Sufficient Cause (?F3), the *First-[Sufficient-]Cause-Principle* ruled causal thought for many centuries: beginning with the time of Aristotle, roughly until the middle of the 17th century – at which time the Principles of Causal Closure (?F4 and ?F5) superseded the First-Cause-Principle at least in the minds of those who considered themselves intellectually advanced[10] (whereas the Principle of Sufficient Cause, as mentioned, remained uncontested even until the beginning of the 20th century). Today, the First-Cause-Principle is entirely neglected – undeservedly.

10. This came about although there is no logical conflict between the First-Cause-Principle and ?F4 or ?F5. However, the First-Cause-Principle traditionally suggested the existence of God – whereas ?F5 and ?F4 did not.

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Prima facie, the First-Cause-Principle has four versions. Its, historically speaking, most frequently used version is this: (i) $\forall y(\exists xCxy \supset \exists x1.Cxy)$ ["Whatever has a sufficient cause also has a *first* sufficient cause"]; the three other versions are these: (ii) $\forall y(\exists xCFxy \supset \exists x1.Cxy)$, (iii) $\forall y(\exists xCxy \supset \exists x1.!Cxy)$, (iv) $\forall y(\exists xCFxy \supset \exists x1.!Cxy)$. The relationships of (broadly logical) entailment between the four versions are the following:

(iv) $\rightarrow$ (iii) $\rightarrow$ (i);

(iv) $\rightarrow$ (ii) $\rightarrow$ (i);

(ii) does not entail (iii), (iii) does not entail (ii).

The avoidance of infinite regress is a requirement for the rationality of any causal explanation. And it follows from the First-Cause-Principle that an infinite regress in causal explanation can always be avoided; this "guarantee" is the *rationale* of the First-Cause-Principle.

In view of this, *which* of the four versions of the First-Cause-Principle is "the best version"? For answering this question, one must take into account that the First-Cause-Principle is supposed to govern causal explanations *in co-operation* with the Principle of Sufficient Cause, and not alone; it is never made use of without the Principle of Sufficient Cause.[11] It is a consequence of this latter principle (and of D3 and P1) that there is a causal factor for y *if, and only if,* there is a sufficient cause of y; and hence that there is *no* causal factor for y *if, and only if,* there is *no* sufficient cause of y. Thus, *given* the Principle of Sufficient Cause, the four versions of the First-Cause-Principle *coincide* (not [purely] logically, but *assuming* the Principle of Sufficient Cause, in view of the definitions D8 and D9).

Both the First-Cause-Principle and the Principle of Sufficient Cause are very rational propositions – which means that they are properly at home in the realm of what *ought to be the case* (rationally); whereas it is doubtful whether they also have a place in the realm of what *is in fact the case*. Both principles are certainly not logically true; but perhaps the First-Cause-Principle is just as *factually correct* as I believe the Principle of Sufficient Cause is. On the other hand, *intersubjectively considered*, both these principles have, no doubt, the same status: of being *in doubt*. Therefore, I add to the list of ?F1, ??F2, ?F3, ?F4, and ?F5:

?F6 $\forall y(\exists xCxy \supset \exists x1.Cxy)$.[12]

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11. In fact, versions (ii) and (iv) of the First-Cause-Principle entail the Principle of Sufficient Cause.

12. Even more doubtful are of course (ii) $\forall y(\exists xCFxy \supset \exists x1.Cxy)$, (iii) $\forall y(\exists xCxy \supset \exists x1.!Cxy)$,

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And I add to the list the even more rational (and more doubtful) *Unique-First-Cause-Principle*:

??F7 $\forall y(\exists xCxy \supset \exists!x1.Cxy)$ ["Whatever has a sufficient cause also has *exactly one* first sufficient cause"].

It is an interesting irony of the history of ideas that belief in the two principles that are at the very heart of causal rationality – the Principle of Sufficient Cause and the First-Cause-Principle – did come to be considered less rational than believing that some items, though there is some causal factor for them, do not have a sufficient cause; or, though they have a sufficient cause, do not have a *first* sufficient cause. Is the taking-into-account of empirical evidence responsible for this astonishing change in philosophical mentality? This is unlikely, for nothing in the world can actually be – broadly speaking – *seen* to have no sufficient cause, let alone to have no first sufficient cause. Rather, what brought about that change seems to be the waning of the theistic world view within the last 400 years: the fall of the First-Cause-Principle – a mainstay of arguing for God – is connected with the rise of the essentially materialistic Principles of Causal Closure, which principles now have managed to eclipse, in most minds, even the Principle of Sufficient Cause – another mainstay of arguing for God.

Lest ?F3, ?F6, and ??F7 seem inherently closer to a particular metaphysical position (theism) than is compatible with their reputation of rationality, it is important to note in this connection that not even a causation of y which is in accordance with the Principle of Sufficient Cause and the *Unique*-First-Cause-Principle is thereby already guaranteed to be a *rational* – let alone a *divine* – instance of causation. If the causation of y in question is to be *rational*, then *the unique first sufficient cause of* y must itself be in some sense *rational* – which would, for example, *not* be the case if the unique first sufficient cause of y were an *absolute* chance-event: not only without any causal factor for it, but also perfectly *blind*. Thus, it should be kept in mind that ?F3, ?F6, and ??F7 can be true – and at the same time the world can be entirely godless, nonetheless.

On the other hand, ?F3, ?F6, and ??F7 are, no doubt, principles that are friendly to theism and to rational agency in general (in particular, to our – human – rational agency). The same is true of the following proposition:

??F8 $\exists y\exists x1Cxy$ ["Something is solo-caused by something"].

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and (iv) $\forall y(\exists xCFxy \supset \exists x1.!Cxy)$.

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??F8 entails not only – on the basis of T1 – ∃y∃x1.Cxy ["Something is first-caused by something"], it also entails ∃y∃!x1.Cxy ["Something has exactly one first sufficient cause"]. For the following can easily be seen to be true:

T3 ∀y(∃x1Cxy ⊃ ∃!x1.Cxy) ["If something has a sole sufficient cause, then it has exactly one first sufficient cause"].

Proof: Suppose ∃x1Cxy, hence by T1: ∃x1.Cxy. Suppose moreover for *reductio*: 1.Cuy and 1.Cu´y, with u≠u´; hence by D8: Cuy and Cu´y, with u≠u´. But this contradicts ∃x¬∃z(z≠x ∧ Czy), which follows from the initial supposition by D10.

And obviously we also have:

T4 ∀x∀y(1Cxy ⊃1.Cxy ∧ ¬∃z(z≠x ∧ 1.Czy)) ["For all x and y: if x solo-causes y, then x is the only first sufficient cause of y"]

Thus, solo-causation very well captures the ideas associated with rational agency: absolute causal spontaneity, absolute causal responsibility. But note: an instance of solo-causation is *in itself* no more guaranteed to be an instance of rational causation than is an instance of unique first-causation. And, of course, it is *doubtful* whether solo-causation ever occurs (the designation of the relevant proposition is "??F8"), even more doubtful than the occurrence of first-causation:

?F9 ∃y∃x1.Cxy ["Something is first-caused by something"].

Indeed, in the 18th and 19th century neither solo-causation nor first-causation had a chance in the minds of the leading intellectuals. If causation is, for the moment, taken to be the causation between *momentary* (and *entire*) *physical world-states* and if, for the moment, we speak *only about such states*, then the causal picture of the world in the 18th and 19th century is seen to be the following: Sufficient causation is a *strict ordering relation* [transitive, irreflexive, and *linear*: ∀x∀y(Cxy ∨ Cyx ∨ x=y)] *which is infinite on both sides* [∀y∃xCxy and ∀x∃yCxy]. Obviously, solo-causation and first-causation have no place in this picture (whereas the Principle of Sufficient Cause *and* the Principles of Causal Closure are perfectly vindicated by it!). *Today*, this picture, though full of *apparent* "holes" (so to speak), still holds many minds in thrall, considering how attractive *determinism* still is. An apparent "hole in the picture" is a y [some momentary physical world-state] which is such that, *apparently*, no x [no momentary physical world-state] causes y; indeed, *apparently*, not even the sum of all x preceding y causes y, although there certainly are z [some momentary physical world-

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states] which are causal factors for y. The most widespread reaction to the apparent "holes in the picture" – which picture, obviously, is the *Laplacian* picture – is not the move of declaring them to be *merely* apparent (as is done in Bohmian physics); nor is the most widespread reaction to them that first-causation, let alone solo-causation, is being given a chance again after centuries (though some marginal and negligible metaphysicians may advocate this); the most widespread reaction is to say that the world-states in question *are not caused at all*, that is: have no sufficient cause, although there are, indeed, causal factors for them. (The consequences of this for the Principle of Sufficient Cause have already been noted earlier in this essay.)

Here, a curious irony usually escapes notice: If some momentary physical world-state is without a sufficient cause, will it also be without an *effect*? Perhaps. But if any momentary physical world-state without sufficient cause effected something (so that this something is being *effected by it* in the sense of D5), then it would be a first sufficient cause of something (in the sense of D8) – and then the idea which so many thinkers in the wake of modern science were eager to get rid of would have an unexpected comeback.

This section should not end without mentioning that the concept of *first sufficient cause* has a counterpart: the concept of *last effect*:

D12 $UFFyx =_{Def} FFyx \wedge \neg\exists zCyz$ ["y is a last – or: ultimate – effect of x if, and only if, y is an effect of x and causes nothing"].

Like the concept of a first sufficient cause, the concept of a last effect is capable of *radicalization*:

D13 $U!FFyx =_{Def} FFyx \wedge \neg\exists zCFyz$ ["y is a *radically* last effect of x if, and only if, y is an effect of x and is a causal factor for nothing"].

Clearly, U!FFyx entails UFFyx (in view of D3 and P1). The converse is not true, and this time not even if ?F3 (that is, the Principle of Sufficient Cause) is presupposed.[13]

Since the 19th century last effects are called "epiphenomena," and it is fair to say: to the extent first causes "fell from grace," last effects – indeed, *radically* last effects – have seemed rather attractive, especially in view of the prospect of giving mental entities *qua nonphysical entities* a place among the actualities, while at the same time keeping them from inter-

13. It may be the case that y is not a sufficient cause of anything and yet be the case that y is a causal factor for something, z. It does follow by ?F3 that something is a sufficient cause of z, but that sufficient cause, of course, needn't be y.

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fering in any way with the causal order of *the physical*. A more recondite point in favor of last effects, and *radically* last effects, is the possibility that there might be an end to time.

Nevertheless, the following proposition, though doubtful, is also vaguely popular these days:

?F10 ∀y(∃zCFzy ⊃ ∃uCFyu) ["Everything for which there is a causal factor is itself a causal factor for something"].

In view of D13, D5, D3 and P1, it follows from ?F10: ¬∃y∃xU!FFyx – "Nothing is a radically last effect." Under ?F10, the mental entities may still be nonphysical entities and, to boot, last effects (though not *radically* last effects). However, if the nonphysical mental entities were last effects *non-radically*, then this would not be in itself sufficient for keeping them from *influencing* even the physical, although it would, indeed, be in itself sufficient for keeping them from *causing* anything physical.

4. The fourth step of analysis: time and causation

The predicate of causation – Cxy – is neither temporally indexical nor does is have a third place: a place for a time-variable. Yet causation seems closely connected to the temporal order. How can this be? The connection of causation to time, where that connection really exists, is established *not* by the causation-relation itself but by the entities that stand in this relation. Aside from the relata of causation, there is no rationale for making causation relative to time; the connection to time is, therefore, *conceptually external* to causation.

Very often (perhaps always) the effect of a (sufficient) cause is a *dated event* (for example, the death of Abraham Lincoln) or a *dated fact* (for example, that Abraham Lincoln died). In these cases, the question "When did x cause y?" can simply be answered by saying "At the time *at which* y *happened* / *at which* y *was the case*." Thus, in those cases, the time of causation is simply *the date of the effect*. It may seem that the time of causation might also be considered to be *the date of the cause*; but rather often the cause (for example, John Wilkes Booth) is not dated: it has no date; it has no date in all those cases where the cause is not a dated event, or dated eventlike particular, or dated fact. Indeed, the cause is not dated in all cases of *causation by an agent*. (Note that events, eventlike particulars, and facts – not dated *or* dated – do not *act* and are, therefore, not *agents*.) But even if the cause is dated, it is rather disputable that the date

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of the cause is the time of causation. After all, it is only the effect which clinches an instance of causation. If, of course, *a dated cause necessitates an effect* (without relying on anything that comes only after its date), then one could very well say that the time of causation is the date of the cause. However, *causation qua necessitation by a dated cause* (without relying on anything that comes only after its date) is not as common as one might prima facie believe it to be. Moreover, the date of a necessitating cause will very likely have to compete with the date of the necessitated effect for being the time of causation. Which of the two dates, then, is *the* time of causation?

Can causation always (in every instance of it) be assigned a time? *Not* if the time of causation is to be determined by its first relatum. If, however, its second relatum is always a dated event, or dated eventlike particular, or dated fact, then causation can always be assigned a time, namely, the date of its second relatum. There do seem to be instances of causation where its second relatum has no date, for example: the parents of John Wilkes Booth caused John Wilkes Booth. But it also seems that all such counterexamples can adequately be regarded as mere *façons de parler* and can easily be reformulated as – *properly speaking* – instances of causation where its second relatum is, after all, *dated*: the parents of John Wilkes Booth caused *the beginning of John Wilkes Booth's life*. We can add to the list of conceptual truths:

P7 $\forall y(\exists x FFyx \supset \exists! u Tuy)$ ["Every effect has one and only one time"],

and to the list of definitions:

D14 $d(y) =_{Def} \iota u Tuy$ ["the date of y is the time of y, *i.e.*, *the* u such that u is a time of y"].

D15 $Cxyu =_{Def} Cxy \wedge u=d(y)$ ["x causes y at time u if, and only if, x causes y and u is the date of y"].

It is, moreover, conceptually true (of all x and y) that if x causes y, then y does not precede x in time, that is: then y is not *before* x in time, that is, the date of y is not before the date of x:

P8 $\forall x \forall y[Cxy \supset \neg BFd(y)d(x)]$.[14]

14. If there is not exactly one u such that u is a time of x – that is, if x is not dated – then $\neg BFd(y)d(x)$ is automatically true. For BFuv entails that both u and v are times (time-points or time-intervals), and if there is not exactly one u such that u is a time of x, then the term $\iota u Tux$, and hence (due to D14) the term d(x), does not refer to a time, but, say,

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The reason for this truth is that x, in causing y, gives to y *something* it, y, does not already have; but if y temporally preceded x, then x could not give *this something* to y.[15]

5. The fifth step of analysis: the core of causation

Having concluded that causation is *sufficient* causation and having seen (fairly comprehensively) how causation, qua sufficient causation, functions in various historical and topical issues of causality, we have now arrived at the central question of the analysis of causation: *What* is it that x, in being a sufficient cause of y, gives to y and that y does not already have? The answer is: *actuality*; in causing y, x makes y, which was not actual before, *actual*.[16] Thus:

P9 $\forall x \forall y[Cxy \supset ACTyd(y) \wedge \forall u(BFud(y) \supset \neg ACTyu)]$ ["For all x and y: if x causes y, then y is actual on the date of y and was not actual at any time before the date of y"].

And, as was mentioned before (in Section 3), nothing can give what it does not already have. Thus:

P10 $\forall x \forall y[Cxy \supset \exists u(BFud(y) \wedge ACTxu)]$ ["For all x and y: if x causes y, then x is actual at a time before the date of y"].

Note that P4 – which, in view of D3, expresses the irreflexivity of causation ("There is no sufficient *causa sui ipsius*") – is an obvious logical consequence of P9 and P10, whereas the impossibility of so-called *backward causation* – which is expressed by P8 – is not a logical consequence of P9 and P10. What does follow from $Cxy \wedge BFd(y)d(x)$ on the basis of P10 is, however, this: $\exists u(BFud(x) \wedge ACTxu)$ – "There is a time, before the date of x, at which x is actual" (because from Cxy by P10 we have $\exists u(BFud(y) \wedge ACTxu)$, and BFud(y) and BFd(y)d(x) together entail BFud(x), due to the transitivity of BF). Now, this *does* seem to be impossible. Consider, for example, *the loss of the Titanic*. This catastrophe caused many things. Suppose it even caused something, y, the date of which, d(y), is *before* the catastrophe's own date, which date is this: from April 14, 1912, 23:46 (ship

to the empty set (or some other appropriate ersatz designatum).

15. The reason *why* is given later in this essay, in the next section.

16. The concept of *truth-maker* is well known in philosophy, but *actuality-makers* – sufficient causes – are rather more fundamental and of wider application than truth-makers.

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time) to April 15, 1912, 2:26 (ship time). Then it follows on the basis of P10 that the loss of the Titanic is actual (and not merely a possibility) at some time before April 14, 1912, etc.!

I take it that, on the contrary, the following is conceptually true:

P11 $\forall x \neg \exists u(BFud(x) \wedge ACTxu)$ ["Nothing is actual at a time before its date"],[17]

and with the help of P11 P8 turns out to be, after all, logically derivable from P10 (as already shown).

Moreover, given that x causes y and *assuming* that the date of x and the date of y are both *time-points*, it follows from P10 and P11 that x, the cause, *is before* y, the effect. For under that *assumption*, we have: either (1) the date of x is before the date of y, *or* (2) the date of y is before the date of x, o*r* (3) the date of x is the date of y. (2) is excluded because of P8 (which, as seen, is a consequence of P10 and P11) and because x causes y. (3) is excluded because x causes y, hence by P10: $\exists u(BFud(y) \wedge ACTxu)$; hence, *if* (3) *were true*, $\exists u(BFud(x) \wedge ACTxu)$ – contradicting P11. Therefore, only (1) remains, which means: x *is before* y.

Moreover, P11 allows us to simplify P9: the expression $\forall u(BFud(y) \supset \neg ACTyu)$ can be dropped from it (as being true of any y, due to P11).

Given Cxy ["x causes y"], we have now seen the following consequences: (i) $\neg BFd(y)d(x)$ by P8 [or: by P10 and P11], (ii) ACTyd(y) by P9, (iii) $\exists u(BFud(y) \wedge ACTxu)$ by P10, (iv) $\neg \exists u(BFud(x) \wedge ACTxu)$ by P11, and (v) $\neg \exists u(BFud(y) \wedge ACTyu)$ by P11. *If*, besides Cxy, we have: $\exists !uTux$, then the causing of y by x is a case of *event/fact-causation* and x, the cause, must be a dated event, a dated eventlike particular, or dated fact – a type of entity that y, the effect, must be in any case (because of P7). And then, because the following principle is conceptually true of all dated entities:

P12 $\forall x[\exists !uTux \supset (\exists uACTxu \supset ACTxd(x))]$ ["Every dated entity which is actual at some time is actual at its own date"],

ACTxd(x) can be derived from $Cxy \wedge \exists !uTux$ (in view of (iii)). *If*, however, instead of $\exists !uTux$ we have $\neg \exists uTux$ besides Cxy, then the causing of y by x is a case of *agent-causation* and $\neg ACTxd(x)$ is a logical consequence (because d(x) is not a time if $\neg \exists uTux$ is true, in view of D14, while ACTxu requires

17. Note that P11 is trivially true for all x which are *not dated*, since there is, of course, no time before "their date" (because "d(x)", for non-dated x, refers to some ersatz designatum which is not a time).

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for its true application that u be *a time*). Note that this consequence does not at all preclude the truth of ∃uACTxu.[18]

P8, P9, P10, P11 – and also P7, which (in consideration of D5 and predicate logic) is logically equivalent to ∀x∀y(Cxy ⊃ ∃!uTuy) – present conceptual *conditiones sine qua non*, "necessary conditions," for causation; but, obviously, not even the conjunction of those conditions amounts to a conceptually *sufficient* condition: they all have merely to do with the relationship of cause and effect to time and actuality, not with the relation of causation *itself*. Still, the predicates "x gives actuality to y" and "x makes y actual", or in one word: "x *actualizes* y," have now been seen to be *revelatory synonyms* (so to speak) of "x causes y," and hence also of "x is a sufficient cause of y" and of "x is a sufficient causal factor for y." We have certainly arrived at the heart of the matter: the core of causation. Can we stop here? Is there no more to say? Indeed, *actualization* seems to be a very robust concept; it need not be analyzed any further. However, even though the core of causation, actualization, is so robust a concept that it need not be analyzed any further, it still remains to be *elucidated* to the extent that it *can* be elucidated (likely by contrast with other concepts). What is it that *actualization* consists in, in addition to what has already been brought to light (for P7 – P11 present conceptually necessary conditions for "x gives actuality to y," "x makes y actual," and "x actualizes y" just as much as for their synonym: "x causes y")?

In the course of the history of ideas, it has seemed to most thinkers that causality has to do with necessity, and that (sufficient) causation, in particular, *is* objective necessitation. This identification makes causation something logically stronger than actualization (for objective necessitation logically implies actualization, but not vice versa). The gist of David Hume's trenchant critique of the identification of causation with objective necessitation is that the only objective necessity we really know of is logical necessity – and that we have no evidence whatsoever that cause and effect are related by logical necessity; on the contrary, all our evidence forcefully suggests that they are not thus related. And even before Hume, the idea of causation as objective necessitation had seemed problematic to some thinkers. Notably, Nicolas Malebranche limited causation to causation *by God* (more closely: to causation by God's volitions) since only in the case of causation *by God* did the objective necessitation of effects appear to be guaranteed beyond reasonable doubt (unfortunately, the existence of

18. Consider John Wilkes Booth again. Since he is a real person, he is actual at some times (back in the 19th century); but he is not actual at *his date*, since there no such thing as a time which is his date (whereas there is indeed a time which is the date of *his life*).

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God is itself not beyond reasonable doubt). In reaction to Hume's attack on causation (as an attack on *causation itself* his critique was widely received), it has seemed to some philosophers that causation is not an objective relation, that it is – not objective but – *subjective* necessitation (as suggested by Hume himself), in particular, *rational* (because cognition-constituting) subjective necessitation (as *not* suggested by Hume himself). Kant and other idealists favored this latter idea; most thinkers, however, did not wish to forgo the objectivity of causation. Neither do I.

Hume was not merely negative on causation; he had also something positive to offer: an idea which was destined to become very influential. According to Hume, x causes y if, and only if, y follows x in time *in accordance with an exceptionless regularity*. There is, however, good reason to be dissatisfied with this *regularity theory of causation*, this time not for epistemological reasons as in the (already considered) case of the *necessitation theory of causation* (albeit the rational cognition of exceptionless regularity in temporal sequences is almost as intractable a problem as the rational cognition of objective necessity in such sequences[19]). The simple and straightforward objection to the regularity theory of causation is that it makes causation – which, as I have argued in this essay, is and ought to be *actualization* – a concept that neither entails actualization nor is entailed by it. If y follows x in time in accordance with an exceptionless regularity, then this, of course, does *by no means* mean that y is actualized by x. Conversely, if y is actualized by x, then this can very well be *without* y following x in time in accordance with an exceptionless regularity (or even without y following x in time in accordance with a merely *statistical* regularity). Accepting the regularity theory of causation has the utterly detrimental effect that it makes people affirm that certain pairs of items are instances of causation which really are no such things, and that it makes people deny that certain other pairs of items are instances of causation which really are such things. The former error has long been noticed, the latter error still goes largely unnoticed. For, due to the influence of the regularity theory of causation, it is widely believed among philosophers and scientists alike: *Where there is no regularity there can be no causality (hence no causation)*. This conviction, if it happens to encounter an evident lack of regularity – even of the statistical kind – in the data, blocks respectable theories from being given a fair chance of correctness; this is how things

19. Hume, a seasoned skeptic, noticed this, and promptly brought up the *problem of induction*. The problem of induction is compounded by the problem of the cognition of objective necessity in temporal sequences if the regularities to be cognized are supposed to be *laws of nature*.

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stand with the causal theory of free action, or – quite a different example – with homeopathic medicine.

There is yet another point in favor of the *actualization theory of causation* (ATC), in addition to the points in favor of it that have become apparent in the last two paragraphs: Neither the necessitation theory (NTC) nor the regularity theory (RTC) – the theories of causation just described – can be friendly to agent-causation. This is due to the fact that a dated entity – the effect – cannot be *directly* connected to a dateless entity – the agent-cause – by necessity or by regularity. A dated entity, *non-causally involving the agent*, has to be interposed – and *then*, unfortunately, this interposed dated entity is likely to be considered the *true* cause and agent-causation appears to be obviously reducible to event/fact-causation. The only possible sequence of adequate analysis under NTC or RTC is this: "He raised his hand": "He caused the [this particular] rising of his hand": "An event/fact centrally involving him caused [necessitated / was followed in accordance with an exceptionless regularity by] the rising of his hand." ATC, however, is rather more flexible: Under ACT, "He caused the rising of his hand" can be read event/fact-causally as "An event/fact centrally involving him *actualized* the rising of his hand" (causation/actualization being taken as a *mere actuality-transfer*[20]); and under ACT, "He caused the rising of his hand" can also be read *irreducibly agent-causally* as "He [he *himself*] *actualized* the rising of his hand" (causation/actualization as an *act*). One of the two readings must be true if "He raised his hand" is true and ACT is true. There is, I submit, no decisive reason against assuming that *he himself* (whoever he is) is the only first sufficient cause/actualizer of the rising of his hand – and of many other events, too.

Reference

Meixner, Uwe. *Theorie der Kausalität. Ein Leitfaden zum Kausalbegriff in zwei Teilen*. Paderborn: Mentis, 2001.[21]

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20. When philosophers consider causation to be *naturalizable* – that is, *physicalizable* – what is being transferred in causation is taken to be *energy* or *momentum*; actuality – not being a notion of physics – is not mentioned. Thus, naturalistic, or: physicalistic, theories of causation confuse what (often) accompanies causation with causation itself. For details, see Meixner, *Theorie der Kausalität*.
21. Why is this book – and only this book – in the Bibliography? For an answer to this question, see footnote 1. (Incidentally, the book contains nine pages of bibliography on books and articles cited in it.)

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