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Causal Laws, Dispositional Properties
and Causal Explanations

Abstract

The role in causal explanation of sentences ascribing dispositional properties to the entities involved is discussed in the light of (a) the counterfactual theory of causal necessity originally proposed by Hume (1777) and more recently by Mackie (1962; 1974), (b) Ryle's (1949) hypothetical analysis of dispositional statements. and (c) Goodman's (1965) observation that counterfactuals are "sustained", not only by causal law statements universally quantified over entities of a given kind, but by dispositional statements which are restricted in their scope to a single individual. It is argued that what is required in order to support a causal counterfactual is universal quantification over a period of time which may be as short as you like, provided (a) that it covers the moment when the event hypothesised in the counterfactual is assumed to have occurred and (b) that its restriction to that period can be rationally justified.

Introduction

My object in this paper is to put forward an account of causal explanation and the role of dispositions in such explanations, which challenges two currently fashionable doctrines in the philosophy of mind. On the one hand, it challenges Donald Davidson's contention in his paper 'Mental events' (1970) that beliefs and desires cannot, under that description, be causes of action, because no causal laws universally quantified over individuals can be stated relating particular beliefs and desires to particular classes of action. It also challenges the view put forward by Peter Geach in Chapter 3 of **Mental Acts** (1957), by David Armstrong in **A Materialist theory of the Mind** (1968), and endorsed by Donald Davidson in 'Mental events' according to which statements which ascribe dispositional properties to an entity, including statements ascribing beliefs and desires and other mental states to a human agent, derive their explanatory force from a reference contained in such statements to the microstructure of the entity concerned in which, on this view, their possession of the disposition in question consists.

The view of causal explanation and the role of dispositional statements in such explanations which I propose to defend brings together three theses which, individually, have been around for a long time, but which have not previously, so far as I am aware, been brought together in the way I am proposing they should be.

The first of these is the Counterfactual theory of Causal necessitation, first put forward, almost as an afterthought, by Hume in his final version of his definition of the causal relation in the **Enquiry Concerning Human Understanding** (1777) and developed more recently by the late John Mackie in his 1962 paper 'Counterfactuals and Causal Laws' and subsequently in his 1974 book **The Cement of the Universe**. The second thesis is the analysis of dispositional statements as concealed hypotheticals, originally put forward by Ryle in Chapter V of **The Concept of Mind** (1949), although I am reliably informed[1] that this idea, like so much else in that book, came to him from Wittgenstein. It was this

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[1] By my colleague Roger White who draws my attention to a number of passages in **The Blue and Brown Books** (Wittgenstein 1958) which support this view. [Footnote added after publication.]

hypothetical analysis of dispositional statements that both Geach (1957) and Armstrong (1968) were challenging in developing their view that the possession of a dispositional property consists in a state of the internal microstructure of the entity that possesses the property. The third thesis which binds the other two together is Nelson Goodman's observation in **Fact Fiction and Forecast** (1965) that [the truth of the counterfactuals involved in causal judgments are deduced from ("sustained" by) subjunctive conditionals or causal law statements of which dispositional statements in which a dispositional property is ascribed to a particular entity is a special case.]

1. The Hume-Mackie Account of Causal Necessity

In his final attempt to produce a satisfactory definition of the causal relationship in the **Enquiry concerning the Human Understanding**, Hume defines a cause as "**An object, followed by another, and where all the objects similar to the first are followed by objects similar to the second.** Or in other words **where if the first object had not been, the second had never existed.**" (Section VII, Part II, p. 76).

Stated in terms which are more congenial to contemporary thought on these matters we can express Hume's final definition as follows:

> A cause is an event or state of affairs which is followed or accompanied by another event or state of affairs such that, other things being equal, whenever an event or state of affairs relevantly similar to the first event or state of affairs occurs or obtains, an event or state of affairs relevantly similar to the second always occurs or obtains. In other words, such that if the first event or state of affairs had not occurred or obtained, the second event or state of affairs would not have occurred or obtained.

When compared with the two definitions of cause given in the **Treatise on Human Nature** (Book I, Part III, Section XIV, Selby-Bigge p. 170) the distinctive feature of this definition is its inclusion of the final sentence in which Hume accounts for the necessary connection between cause and effect in terms of the truth of the counterfactual "**If the first object had not been, the second had never existed.**" But what is also striking is that he takes this counterfactual to be an alternative way of stating the paradigm of a causal law statement "**where all objects similar to the first are followed by objects similar to the second.**"

More recently this counterfactual theory of causal necessity has been developed by the late John Mackie in his `Counterfactuals and Causal Laws' paper (Mackie 1962) and his book **The Cement of the Universe** (1974).

As I see it, this account of causal necessity has the following virtues:

(a) it clearly differentiates causal necessity from logical necessity,

(b) it explains why Hume wasn't able to observe the 'cement' which sticks the cause to the effect, since we can never observe what [would] have happened if things had been different from the way they actually were,

(c) it explains why both in the first of his two definitions of cause in the **Treatise** (1739) and in the first version of his definition in the **Enquiry** (1777), Hume gives an account of the necessary connection between a cause and a particular effect on a particular occasion in terms of the truth of a universal law statement to the effect that all states or events which are relevantly similar to the cause in question are invariably followed or accompanied by similar effects. The point here being that, since the truth of a counterfactual necessarily cannot be established by observation, its truth can only be established by deducing it from a universal law-statement or other law-like principle the truth of which is established on other grounds (e.g. by experimental test).

2. Ryle's Hypothetical Analysis of Dispositional Statements

According to Ryle (**The Concept of Mind**, 1949, Chapter V), to say of a piece of glass that it is brittle is to say of it that if at any time it is struck with sufficient force by a hard object or dropped with sufficient force onto a hard surface it will break, and nothing more.

Hence to ascribe a dispositional property to someone or something is to say something hypothetical about how the person or entity in question **would** or **could** behave, if at any time certain specifiable conditions are fulfilled. It is not to say anything categorical about it.

Ryle notes

(a) that such dispositional statements are "law-like",[2]

(b) that they "license" the drawing of inferences from them about what would happen in particular circumstances.[3]

Ryle distinguishes

(a) universal dispositions like the brittleness of glass in general,[4]

(b) particular dispositions like the particular degree of brittleness characteristic of this particular piece of glass.[5]

Ryle maintains that all mental state verbs, both cognitive verbs like 'know', 'believe', 'understand', 'remember' etc. and volitional verbs like 'want', 'fear', 'like', 'dislike', 'intend' etc. are dispositional in the sense that to describe someone as 'knowing', 'believing', or 'wanting something' is to ascribe a particular dispositional property to them and hence to say of them something about what they would or could think, say or do, if at any time certain broadly specifiable conditions are fulfilled, and nothing more.

3. Goodman on the Generation of Counterfactuals

[section about John Mackie is removed; the next section is rewritten in two new sections; footnote 6 is also added after publication of this paper]

In his book **Fact, Fiction and Forecast**, first published in 1955, Nelson Goodman (1965) draws attention to the fact that not all universally quantified propositions will yield the kind of counterfactual statement which, on the view endorsed above, is entailed by any particular causal judgment. A distinction needs to be drawn between an **accidental generalisation** such as "All coins in my pocket are silver" which does **not** yield the counterfactual 'If this coin were in my pocket, it would be silver' and a **causal law statement**

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[2] "For though assertions that mentioned individuals have capacities, liabilities, tendencies and the rest are not themselves statements of laws, they have features which can best be brought out after some peculiarities of law sentences have been discussed." (Ryle 1949 p.120)

[3] "A law is used as, so to speak, an inference-ticket (a season ticket) which licenses its possessors to move from asserting factual statements to asserting other factual statements." (**Ibid.** p.121)

[4] This is not strictly accurate. Ryle's distinction is between "law-propositions" and "law-like propositions" (**Ibid.** p.167) where a law-like sentence is one in which a disposition is predicated of an individual. He ignores universally quantified dispositional statements like **Glass is brittle, Rubber is flexible** and **Paper is inflammable,** though, by his criteria, these would qualify as law-sentences rather than law-like sentences.

[5] "We can now come back to consider dispositional statements, namely statements to the effect that a mentioned thing, beast or person, has a certain capacity, tendency or propensity, or is subject to a certain liability. It is clear that such statements are not laws, for they mention particular things or persons." (**Ibid.** p.123)

such as "All butter melts at 150° F" which **does** yield the causal counterfactual 'If this butter had been heated to 150° F, it would have melted' (Goodman 1965, pp. 18-25) .

Goodman also draws attention to the fact that you don't need a universally quantified causal law in order to generate a counterfactual. A particular dispositional statement ascribing a dispositional property to a particular person or entity will do just as well. Given that you know that a particular piece of glass is particularly brittle, you can quite properly infer that if it had been struck moderately hard by a hard object it would have broken, or to use Goodmans' example, if we know that "**w** is inflammable", we can infer that "if **w** had been heated enough, it would have burned." (Goodman 1965, p.39)[6]

When we compare accidental generalisations, which do **not** yield counterfactuals and subjunctive conditionals, with particular dispositional statements which **do**, it becomes apparent

(a) that universal quantification over the entities involved is not a necessary condition for the legitimate generation of counterfactuals and subjunctive conditionals,

(b) that all that is required in order to generate counterfactual and subjunctive conditionals and hence, on Mackie's theory, causal judgments is a statement of the form **If at any time between time** t_1 **and time** t_n, **an event of type** A **occurs, other things being equal, an event of type** B **will occur**. Such statements are universally quantified over a limited period of time which in the case, for example, of the more evanescent of human beliefs may be no longer than a second or two.

4. The Mackie-Ryle-Goodman Account of Causal Judgments

If we combine Ryle's hypothetical analysis of statements with the Hume-Mackie analysis of causal necessity in terms of the truth of a counterfactual to the effect that if the cause had not occurred or been the case, the effect would not have occurred or been the case, and Goodman's observation that particular dispositional statements are subjunctive conditionals capable of yielding counterfactual conditionals without needing support from causal laws universally quantified over individuals, we find that we now have an analysis of causal judgments which is a serious rival to the currently fashionable view represented by the work of Donald Davidson. According to Davidson (1967) "our justification for accepting a singular causal statement is that we have reason to believe an appropriate causal law exists, though we do not know what it is." From his insistence that we do not need to know, i.e., be in a position to state, the causal law in question and from the example that he gives (the effect of striking a match) it is evident that the causal laws he has in mind are universally quantified over individuals. Moreover in the case of the mental dispositions like believing and wanting which he discusses in his 1970 paper 'Mental events', if not in the case of non-mental dispositions like the brittleness of glass, Davidson follows Geach (1957) and Armstrong (1968) in holding that dispositional statements derive their causal explanatory force from a similar implicit reference to the unknown microstructure of the entity concerned in which, according to this view, the dispositional property is supposed to consist.

It is a serious objection both to the Davidsonian thesis that causal judgments require backing up by causal laws universally quantified over individuals and to the Geach-Armstrong account of the explanatory force of dispositional statements in terms of an implicit reference to the state of the microstructure of the entity concerned, that the man or woman in the street who has no scientific knowledge either of the causal laws which are supposed to underpin causal judgments or of the microstructure of the entities with whose dispositional properties he or she is familiar in everyday life, has no difficulty whatever in making causal judgments, in understanding the explanatory force of attributing a dispositional property to someone or

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[6] This, again, is not strictly accurate. In fact Goodman's claim is that "**w** is inflammable" is roughly equivalent to, though weaker (? less specific) than, "If **w** had been heated enough, it would have burned" or, more exactly, "If all conditions had been propitious and **w** had been heated enough, it would have burned." He apparently fails to notice an important respect in which "**w** is inflammable" is stronger (in the sense of 'more inclusive') than the counterfactual, in that, beside the counterfactual, it also yields the prediction 'If in the future all conditions are propitious and **w** is heated enough, it will burn.'

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something, or in making perfectly legitimate counterfactual and subjunctive inferences from such statements. The theory which I have culled from the writings of Hume, Mackie, Ryle and Goodman by contrast has no difficulty in accounting such facts.

5. Implications for the Causal Theory of Action

The Mackie-Ryle-Goodman account of causal judgments, if accepted, would seem to have some important implications for the Causal Theory of Action (Davidson 1963).

In the first place since it denies that causal judgments need to be backed up by causal laws universally quantified over individuals, it undermines Davidson's (1970) argument for saying that the beliefs and desires of the agent cannot **under that description** be causally explanatory of the agent's behaviour.

Secondly, no one, since the point was first argued by Ryle (1949), has seriously disputed the claim that statements ascribing a mental state to someone are dispositional. It follows from this on what I am calling the Mackie-Ryle-Goodman view not only that explanations involving the ascription of mental states are capable of generating counterfactuals without the need for any assistance from universally quantified causal law statements, but also - precisely because they sustain these counterfactuals - there is no possible reason on the Mackie-Ryle-Goodman view for denying that such explanations are causally explanatory. But does this allow us to say that beliefs and desires are the causes of what an agent does when acting on them?

On Mackie's account of causation to say that **A** is a cause of **B** is simply to say, in the case where **A** and **B** are independently characterisable states or events, that, other things being equal, if **A** had not occurred or been the case **B** would not have occurred or been the case. By that criterion, possessing a dispositional property like a particular degree of brittleness or a particular belief **is** a cause of the glass's breaking or of the agent's acting as he/she does. For it is true both that the glass would not have broken when struck by the stone, if it had not been as brittle as it was, and that the agent would not have acted as he/she did, if he/she had had different beliefs.

But what is the law-like statement from which **these** counterfactuals are deduced? What, in other words, is the law-like statement which, on the counterfactual theory of causal necessitation, justifies the claim that the possession of a dispositional property such as a particular degree of brittleness in the case of a pane of glass or the belief that it is going to rain in the case of a human agent is a cause respectively of the breaking of the glass or the human agent's taking an umbrella with him on going out? Is this the counterfactual that requires a causal law universally quantified over individuals? I do not think so.

It seems to me that all that is required to yield a counterfactual statement to the effect that the glass would not have broken when hit by the stone, if it had not been as brittle as it was or that a human agent would not have taken his umbrella with him when he went out, if he had not believed it was likely to rain, is the law-like statement implied in the one case by the statement that the pane was as brittle as in fact it was and in the other by the statement that the ∧human agent believed that it was likely to rain.   In other words what I am proposing is that we parse the statement **If the pane of glass had not been as brittle as in fact it was, it would not have broken when hit by the stone** as **If it had not been the case that the pane of glass would have broken, if at any time it had been struck by a hard object with a force of between** x **and** y **kilograms per square centimetre, it would not have broken when it was in fact hit by the stone with a force of that magnitude**. And that, I submit, though it **is** a bit of a mouthful, is not incoherent.

6. Some Objections Considered

There are, of course, a number of objections to parts of this account which need to be considered. Thus, in his discussion of David Lewis' (1973) presentation of the counterfactual theory of causal necessitation, Kim (1973) gives three examples of counterfactuals involving events and states of affairs which we would not ordinarily describe as causally connected. To my mind, these do not present a serious threat to the counterfactual theory, since in no case do the events or states of affairs involved satisfy Hume's (1777;

Sect. IV, Part I, 25) requirement that cause and effect be "distinct events". They are either defined in relation to one another, as in the case of "Monday" and "Tuesday" in the example

"If yesterday had not been Monday, today would not have been Tuesday." (Kim 1973 p.570)

or in terms of one another, as in the case of "being born in 1950" and "becoming 21 in 1971" in the example

"If George had not been born in 1950, he would not have reached the age of 21 in 1971." (Kim 1973 p.570)

or as in the case of "a child being born to a sibling" and "becoming an uncle" in the example

"If my sister had not given birth at **t**, I would not have become an uncle at **t**." (Kim 1973 p.571)[7]

A more searching objection is that expressed by Lewis himself in the course of introducing his own exposition of the counterfactual theory:

"We have learned all too well that counterfactuals are ill understood, wherefore it did not seem that much understanding could be gained by using them to analyze causation or anything else." (Lewis, 1973 p.557)

The same objection to the use of counterfactual conditionals in explanation is raised by Geach in his criticism of Ryle's hypothetical analysis of dispositional statements:

"It ought to be, but plainly is not, generally known to philosophers that the logic of counterfactual conditionals is a very ill-explored territory; no adequate formal logic for them has yet been devised, and there is an extensive literature on the thorny problems that crop up. It is really a scandal that people should count it a philosophical advance to adopt a programme of analysing ostensible categoricals into unfulfilled conditionals, like the programmes of phenomenalists with regard to 'physical object' statements and of neo-behaviourists with regard to psychological statements." (Geach 1957 pp.6-7)

7. Intensional versus Extensional Logic

As the quotation from Geach (1957) makes clear, this objection to the use of counterfactual conditionals for explanatory purposes, whether in relation to causation or in relation to dispositions, rests on the assumption that it is a necessary, if not a sufficient condition, for achieving clarity in a philosophical thesis that it be susceptible to perspicuous representation in terms of some viable system of formal logic, such as the predicate calculus. Since no formal representation of a counterfactual conditional exists which is generally accepted by logicians and since there is little reason to think that such a representation is likely to be forthcoming, it follows, on this assumption, that a philosophical thesis which offers a counterfactual conditional as an analysis of a causal or dispositional statement is simply piling obscurity onto obs[c]urity.

If, however, we pause to consider why it is that no acceptable formal representation of a counterfactual conditional has ever been given, it becomes apparent, I suggest, that the only systems of formal logic that

[7] Two other examples given by Kim - "If I had not written 'r' twice in succession, I would not have written 'Larry'" and "If I had not turned the knob, I would not have opened the window." (Kim 1973 p.571) - appear to be straightfoward causal counterfactuals. In these cases "writing 'r' twice in succession" and "writing 'Larry'" in the one case and "turning the knob" and "opening the window" in the other are discrete events. This is shown by the fact that whereas I cannot write 'Larry' without writing 'r' twice in succession and cannot open the window without turning the knob, I **can** write 'r' twice in succession without writing 'Larry' and I **can** turn the knob without opening the window. By contrast yesterday could not have been Monday without today being Tuesday, George could not have been born in 1950 without, assuming he was still alive, becoming 21 in 1971, and my sister could not have given birth without my becoming an uncle, assuming that I was alive at the time. [This footnote is added after publication and replaces text that was original in the body of the paper.]

are non-problematic are **extensional**, whereas counterfactual conditionals and their role in the elucidation of causes and dispositions only make sense within the context of an **intensional** logic for which no acceptable formal representation has yet been devised.

As I understand the matter, an extensional logic is one in which deductive inferences are justified solely in accordance with the principles of class membership and class inclusion. These are the principles according to which the application of a predicate to an object (in the case of class membership) or to a class (in the case of class inclusion) can be inferred, if and only if (a) that object or class exists, in the tenseless sense of that word typified by the existence of numbers and which includes, besides what exists now, both what has existed in the past and, where this is determinable, what will exist in the future, and (b) the class of actually existing objects which fall under the predicate includes or coincides with the object or class in question.

Counterfactuals in general and causal counterfactuals in particular are problematic from the standpoint of this kind of logic for at least three reasons:

(1) they concern events and states of affairs which are non-occurrent or non-existent;

(2) we want to say that the counterfactual as a whole is true, and non-trivially true, despite the fact that both its constituent propositions, since they describe what is non-existent or non-occurrent, are false;

(3) we want to say that, in the causal case, the truth of the counterfactual "explains" the truth of a proposition describing the actual state of affairs or succession of events in a sense which implies some kind of inference from the counterfactual to the actual.

It is my contention that we can only make sense of these features if they are viewed from the standpoint of a logic which is intensional rather than extensional. An intensional logic, as its name implies, is one in which deductive inferences depend on the relation between the intensions or senses of the predicates contained in a sentence, rather than on the relation between their extensions, as in an extensional logic. In other words an intensional logic takes account of what might be, as well as what actually is. Unfortunately a price has to be paid for this extension of the scope of logic so as to include the possible as well as the actual. Where the extensions of two predicates coincide or the extension of one includes that of another, it is always conceivable that instances might exist which would fall outside the scope of one or both of two otherwise co-extensive predicates or of the more comprehensive of two predicates which otherwise includes the complete extension of the other predicate. In order to allow for this possibility it is necessary, in an intensional logic, to restrict deductive inferences to those cases where this possibility is excluded, either (a) by the existence of an analytic connection between the intensions or senses of the predicates involved, or (b) by the introduction of a causal law or "law-like" subjunctive conditional which, in Ryle's phrase, "licenses" the inference in question. Needless to say, it is precisely this "licensing" of inferences by subjunctive conditionals within the framework of an intensional logic which allows us to make sense of the part played by counterfactuals in causal explanation.

At the same time, the restriction of legitimate inference within an intensional logic to those which are justified either by an analytic connection between the predicates involved or by some kind of separate covering law statement limits the rigour and generality of the proofs and, hence, the scope for formalisation that is possible within such a logical system. Analytic truths are a particular headache from the standpoint of the formal logician who wants everything out in the open and above board. For, except in the case of certain precisely defined scientific concepts, we have to rely on the linguistic intuitions of native speakers of the natural language concerned in order to determine which sentences are analytic, i.e., true solely by virtue of the linguistic conventions which determine the intensions of the predicates involved, and which are synthetic, i.e., true in that, given those conventions, they correspond to the way things are in the extra-linguistic universe.

8. Conclusion

Because of the importance that is rightly attached to rigour and generality in scientific theory, it has been widely assumed by philosophers of science that scientific theory should ideally be constructed on the foundations of an extensional logic, such as the predicate calculus. On the other hand, it has long been recognised that the logic required to make sense of the distinctions embedded in ordinary language is intensional rather than extensional. Perhaps the most striking evidence of this is the distinction that is drawn in ordinary language between the extensional forms of the universal quantifier, **all** and **every**, and the intensional form **any**.[8] There is no way of making, let alone marking, this distinction within a purely extensional logic.

These intensional features of ordinary language have never worried the advocates of an extensional logic as the basis for science, because they have been able to represent ordinary language as in these respects an imperfect instrument, lacking the precision and rigour required for scientific purposes. Yet if I am right in thinking (a) that the determination of causal relations is of the essence of empirical science, (b) that causal relations need to be interpreted in terms of counterfactuals, and (c) that the role of counterfactuals in causal explanation can only be understood within the framework of an intensional logic, it follows that there can be no way of adequately representing the fundamental propositions of empirical science in terms of an extensional logic such as the predicate calculus.

Acknowledgment

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[8] Compare the accidental generalisation
Everyone in this room speaks English
with the rule
Anybody admitted to this room has to speak English.