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CAUSALLY RELEVANT PROPERTIES

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In this paper I present an analysis of causal relevance for properties. I believe that most of us are already familiar with the notion of a causally relevant property. But some of us may not recognize it "under that description." So I begin below with some intuitive explanations and some illustrative examples.

A causally relevant property is a certain kind of property of causes. Every cause of an effect has many different properties. But many properties of a cause appear to have no role in causing its effect. Those properties of the cause are causally irrelevant to the effect. The properties of a cause that do have some role in causing its effect are causally relevant to the effect.

Here are some more rough-and-ready explanations of the idea. If a cause causes an effect in part because it has a certain property, then that property of the cause is causally relevant to the effect. The causally relevant properties of a cause are those in virtue of which it causes its effect. A cause's causally relevant properties are those it needs to cause its effect. They are the properties that make a difference to the effect.

An illustration: Suppose a rock collides with a window, causing the window to break. The collision causes the window to break (in part) because the rock has a certain momentum and

because the window is made of a certain fragile sort of glass. So the collision causes the breaking partly because the rock and the window have those properties. So those properties are causally relevant to the window's breaking. But not every property of those entities is causally relevant to the breaking. For instance, the window does not break because the rock has a red spot on it, or because the collision occurs simultaneously with George's sneeze (which occurs 10 miles away). Those properties of the rock and the collision are causally irrelevant to the breaking.

Consider another example (this one adapted from Dretske, 1989). Suppose Wilma is a skilled soprano. Suppose she sings the word 'shatter' at a high pitch and amplitude, causing a nearby glass to vibrate and shatter. Wilma's singing causes the glass's shattering because of its high pitch and amplitude. So those properties of her singing are causally relevant to the shattering. However, the shattering does not occur because Wilma's singing means shatter. That property is causally irrelevant to the shattering.

We are clearly able to make judgments about causal relevance. Admittedly, there are some cases about which we lack strong intuitions. But it's also undeniable that we have strong intuitions in many cases. Thus we have good reason to believe that there is a real difference between causally relevant and irrelevant properties. Therefore I believe it is worthwhile attempting to find an analysis of causal relevance. (If we cannot find an analysis, then it is worthwhile trying to obtain clearer explanations of causal relevance, or at least more information about it.)

This is what I try to do below. To be precise, I attempt to give a set of modally necessary and sufficient conditions for being a causally relevant property. Before presenting my analysis, I

criticize another analysis of causal relevance that relies heavily on counterfactuals. I then present and criticize an alternative analysis that relies on essential properties. This last analysis serves as a basis for my final analysis.

Many philosophers who have written about causally relevant properties have been especially concerned with the causal relevance of mental properties to actions.¹ This was also my main interest when I began thinking about causally relevant properties. In this paper, however, I am concerned with the metaphysics of causally relevant properties in general. But in the last section I do attempt to apply my analysis to mental properties.

1. Preliminaries: Events, Causation, and Properties

I will assume here that causes and effects are always individual (token) events. The collision of the rock with the window, and the window's breaking, are events; so are Wilma's singing and the glass's shattering. I include among events such "uneventful events" as the window's retaining a certain composition and shape throughout the day preceding its breaking.

I will also assume a liberal view of which events count as causes. I will assume that an "uneventful event" can be a cause. For instance, the window's retaining its shape and composition throughout the day preceding the breaking is one cause of its breaking. I will furthermore assume that any event that occurs in the causal history of an event is a cause of that later event. For instance, Wilma's birth is a cause of Wilma's singing.²

Events, like other individuals, have properties. Some of these properties are essential and some not. (A property is essential to x iff it is metaphysically necessary that if x exists, then x has that property.) For instance, it's plausible to suppose that Wilma's singing has its pitch

essentially. But the property of taking place simultaneously with Sylvester's cough (suppose Sylvester is very far from the scene) seems not to be essential to the singing---the singing could have occurred even if the cough had never occurred.

Some philosophers hold that an event just is something like an instance of a property, or a property of a region, or a property of a substance at a time.³ I think these attempts at analyzing the notion of an event are useful as rough explanations of what an event is. But I do not accept them as analyses. Nevertheless, much of what I say in this paper about events and causally relevant properties is compatible with these views.

At the beginning of this essay, I said that properties of various objects were causally relevant to the window's breaking. For instance, I said that the momentum of the rock was causally relevant to the window's breaking. But from here on I will be concerned only with properties of events, and with the analysis of the notion of an event's causally relevant properties. This restriction is justified by my assumption that causation is a relation between events: if this assumption is correct, and we are interested in the properties of causes in virtue of which they cause their effects, then we should concentrate on properties of events. My restriction to properties of events is not so severe as it may seem. If an object involved in causing an effect seems to have a causally relevant property, then this property can always be "viewed as" a property of an event. For instance, if the rock has a certain momentum M when it collides with the window, then the collision (that event) has the property of being-a-collision-with-an-object-that-has-momentum- M . This seems to be a causally relevant property of the collision.

2. A Counterfactual Analysis

Let's turn to Wilma's singing and the glass's shattering to motivate our first analysis of causal relevance. The meaning of Wilma's singing is, in some sense, unnecessary to the shattering, whereas the pitch and amplitude are, in that same sense, necessary. So it's very natural to say the following: If Wilma's singing had meant something different, or meant nothing at all, then the shattering would still have occurred; but if Wilma's singing had lacked that pitch and amplitude, the shattering would not have occurred.⁴

LePore and Loewer (1987, 1989), Horgan (1989), and others try to elevate remarks like these into an analysis of causal relevance.⁵ LePore and Loewer's (1987) attempt at such an analysis is the following (with slight changes in wording):

If *c* and *e* are events, and *F* is a property, then *c*'s being *F* is causally relevant to *e*'s being *G* iff

- (1) *c* causes *e*.
- (2) *c* is *F* and *e* is *G*.
- (3) If it were not the case that *c* is *F*, then it would not be the case that *e* is *G*.
- (4) That *c* is *F* and that *e* is *G* are metaphysically and logically independent.

A few remarks about this analysis. One might wonder whether LePore and Loewer have fixed on the right analysandum. If we are concerned with analyzing causal relevance, should the analysandum be

c's being *F* is causally relevant to *e*'s being *G*

or

c's being F is causally relevant to e's occurrence?

The first analysandum mentions some property of the effect.⁶ The second analysandum seems more "minimal," since in order for an event e to be G, e must at least occur. In what follows, I concentrate on the task of analyzing the more minimal notion of a property's being causally relevant to an event's occurrence. We can modify LePore and Loewer's analysis to get an analysis of this more minimal analysandum in the following way.

If c and e are events, and F is a property, then c's being F is causally relevant to e
(or e's occurrence) iff

- (1) c causes e.
- (2) c is F.
- (3) If it were not the case that c is F, then it would not be the case that e occurs.
- (4) That c is F and that e occurs are metaphysically and logically independent.

Call this the Counterfactual Analysis.

There is a second question one might have about the analysandum: to what do we refer when we say "c's being F"? We don't merely refer to the event c; but we shouldn't refer to some other event, either. Do we, perhaps, refer to a fact or state of affairs? To avoid these worries, we should view the analysandum here as a three-place relation between a property and two events (taken in a certain order). We can more perspicuously state the analysandum as "property F is causally relevant with respect to c and e". But I will continue to use the more convenient, if slightly misleading, "c's being F" terminology.

The Counterfactual Analysis is very intuitive---these counterfactuals fairly leap to mind when we think about causal relevance. It's also an intuitive advantage for the Counterfactual Analysis that it links causal relevance to counterfactual dependence, since event causation itself seems to have some sort of connection with counterfactual dependence. Nevertheless, the Counterfactual Analysis has serious problems, which I believe make it unacceptable.⁷

3. Criticisms of the Counterfactual Analysis

3.1. Pre-emption Counterfactual analyses of event causation have well-known problems with pre-emption.⁸ The Counterfactual Analysis of causally relevant properties has similar problems with pre-empting causes.

Consider Wilma again, a moment before she begins to sing. Suppose that her friend Betty is in the same room. Betty has also decided to try to break the glass by singing. Wilma begins to sing, and the glass begins to vibrate. Betty begins to sing also, but before her singing becomes audible, the glass shatters.

It's clear that Wilma's singing causes the shattering, and that the pitch of her singing is causally relevant to the shattering. But the counterfactual analysis entails that the pitch of Wilma's singing is causally irrelevant. For in these circumstances, the following counterfactual is false:

If Wilma's singing had not had pitch P, then the shattering would not have occurred.

If Wilma's singing had not had pitch P, then Betty's singing would have caused the glass to

shatter. So on the counterfactual analysis, the pitch of Wilma's singing is causally irrelevant.⁹

3.2. Closely Related Properties If we want to determine whether the amplitude of Wilma's singing is causally relevant to the shattering, the Counterfactual Analysis urges us to imagine a situation in which Wilma's singing lacks its actual amplitude. We are then supposed to imagine what other properties Wilma's singing would have in this situation. One seemingly appropriate situation to imagine is one in which Wilma's singing has an amplitude that's only slightly different from its actual amplitude. This sort of situation seems closer to actuality than any situation in which her singing differs dramatically in its amplitude.

If this is right, then there is a problem for the Counterfactual Analysis. For if Wilma's singing had had only a slightly different amplitude, then the glass (probably) would still have broken. So by the Counterfactual Analysis, the actual amplitude of Wilma's singing is causally irrelevant.

I call this 'the problem of closely related properties'. In many cases where some property is causally relevant to an effect, another closely related property would have done the job as well. Furthermore, if the event had lacked its actual property, it might well have had the closely related property. This problem afflicts the Counterfactual Analysis's handling of many examples. For instance, the Counterfactual Analysis has a problem with the various, slightly different, momenta that the rock could have had as it collided with the window.¹⁰

3.3. Negative Properties The Counterfactual Analysis has problems with at least some properties which we might naturally call "negative properties." Consider Wilma's case again, and

consider the property of not-occurring-next-to-a-soundproof-wall. Wilma's singing has this property, since Wilma is not singing near a soundproof wall. But if she had been next to a soundproof wall, placed between her and the glass, then the glass would not have shattered. So it seems that the following counterfactual is true:

If Wilma's singing had lacked the property of not occurring next to a (suitably placed) soundproof wall, then the shattering would not have occurred.

So on the Counterfactual Analysis this negative property is causally relevant to the glass's shattering. But this seems wrong. Furthermore, it's easy to generate many other negative properties, one for each "interfering factor" that might have been present, and the Counterfactual Analysis will count each of these as causally relevant. For instance, the glass does not have a blanket over it; if it had, the shattering would not have occurred. So the property of not-occurring-as-the-glass-had-a-blanket-over-it is causally relevant by the counterfactual test. Similarly, there was no person who grabbed the glass, there was no machine generating counteracting sound waves, and so on. But surely not all of the corresponding negative properties are causally relevant to the shattering.¹¹

3.4. Universal Properties Let's say that a universal property is one which every object (in a world) either has or lacks. There are at least two sorts of universal properties that raise problems for the counterfactual analysis.¹²

Consider the rather odd property of being such that force equals mass times acceleration. An object has this property as long as $F=ma$; so Wilma's singing has this property (if $F=ma$). In fact, for every natural law, there is a property which an object has just in case that law holds, and

Wilma's singing has all those properties, too. Let P, Q, R, . . . be the various natural laws which "cover" the events that occur when Wilma's singing causes the shattering, and consider the following counterfactual:

If Wilma's singing had lacked the property of being such that P, Q, R, ..., then the shattering would not have occurred.

This says, in effect, that if some of the laws had not held, then the shattering would not have occurred. It seems to be true. If it is true, then on the Counterfactual Analysis, a property of having a law hold is causally relevant. But this is counterintuitive. The properties mentioned by a law are likely candidates for being causally relevant. Not so for the property of a law's holding.

Here is another case involving universal properties. Suppose that Wilma's singing occurs at time t , and that the shattering occurs at t' . Now consider the property of being such that some object exists at t' . Wilma's singing has this property, since some object exists at t' . But if her singing had lacked that property, then the glass's shattering would never have occurred. So by the counterfactual analysis, this property is a causally relevant property of Wilma's singing. Again, this is counterintuitive.¹³

This ends my criticisms of the Counterfactual Analysis. I do not maintain that these criticisms are conclusive. But the number and variety of problems are sufficient to motivate looking for a different sort of analysis of causal relevance.

4. The Essentialist Analysis

To obtain our next analysis, let's begin with the relation of causal relevance between events, and then build on this to get a relation of causal relevance between properties and events. When should we say that one event is causally relevant to another event? One obvious answer is, "when the first is a cause of the second." So we get

(E) If c and e are events, then c is causally relevant to e iff c is a cause of e .¹⁴

Now let's return to our original notion, that of an event's having a property that is causally relevant to another event. (A three-place relation, as I mentioned above.) Let's consider the following proposal: a property is causally relevant to an effect iff it is essential to an event that is causally relevant to that effect. Or, in other words, causally relevant properties are essential properties of causes.

(E3) If c and e are events, and F is a property, then c 's being F is causally relevant to e iff

(1) c is causally relevant to e (i.e., c is a cause of e).

(2) c is essentially F .

Call this the 'Essentialist Analysis'. (I have labeled it 'E3' because it is an essentialist analysis of a three-place relation.)

The Essentialist Analysis might be surprising, but I think it is intuitively plausible (on reflection).¹⁵ The notion of a causally relevant property is, very roughly, that of a property which is "needed," in some sense, for an effect to occur, and which is involved somehow in causing the effect. Both of these intuitive desiderata are met by the Essentialist Analysis. Take some effect. That effect "needs" its causes in order to occur. Those causes also "need" their essential

properties in order to occur. So an effect does, in a sense, "need" the essential properties of its causes in order to occur.

We are also inclined to say that a causally relevant property is a property that "makes a difference" to whether or not an effect occurs. On the Essentialist Analysis, a causally relevant property makes a difference to whether or not a cause occurs, for a cause cannot occur without having its essential properties. A cause, in turn, makes a (causal) difference to whether its effect occurs. So there is a strong sense in which a causally relevant property makes a difference to whether an effect occurs.

The Essentialist Analysis can also explain the successes of the Counterfactual Analysis, and our natural inclination to use counterfactuals when thinking about causal relevance. On the Essentialist Analysis, a counterfactual of the form "if the cause had not had that property, then the effect would not have occurred" is true, when the property is causally relevant. For if the property is causally relevant on the Essentialist Analysis, then it is essential to the cause, and so the counterfactual has an impossible antecedent. On standard (Stalnaker-Lewis) accounts of counterfactuals, counterfactuals with impossible antecedents are vacuously true. So assuming this standard account, the counterfactual will be true whenever the property mentioned is essential to the cause.¹⁶ Therefore, if a property is causally relevant according to the Essentialist Analysis, then it is also causally relevant according to the Counterfactual Analysis.¹⁷

The converse holds in many cases, but not all. The differences allow the Essentialist Analysis to handle some cases that are problematic for counterfactual analyses. Pre-emption is no problem; if the property is essential to an actual cause, then the fact that the cause might have been pre-empted does not matter. Closely related problems do not present a difficulty. If the

amplitude of Wilma's singing is essential to it, then the existence of closely related amplitudes is unimportant. The universal properties and negative properties that I mentioned above are not essential properties of the causes, so the Essentialist Analysis does not entail that they are causally relevant.¹⁸

We can existentially generalize on the Essentialist Analysis to get analyses of (i) the notion of a property that is causally relevant to an event (a two-place relation between properties and events); and (ii) the notion of a causally relevant property tout court (a one-place property of properties).¹⁹

(E2) If e is an event and F is a property, then F is causally relevant to e iff: there is an event c such that

(1) c is causally relevant to e (c is a cause of e).

(2) c is essentially F .

(E1) If F is a property, then F is a causally relevant property iff: there are events c and e such that

(1) c is causally relevant to e (c is a cause of e).

(2) c is essentially F .

5. The Essentialist Analysis and Event Individuation

There is another strong motivation for the Essentialist Analysis that I want to mention. It has to do with event individuation and causation. I can best explain it by example.²⁰

Suppose that Fred says 'hello' rather too loudly. It is plausible to think that there are at least two events occurring as Fred utters 'hello'. One event is essentially a saying-'hello' and

essentially loud. The other event is also essentially a saying-'hello', but only accidentally loud. Both occur in the same location, and both are loud, but they are distinct, since only the second could have been soft. Though distinct, these events are closely related. For instance, the first necessitates the second: it is necessary that if the first occurs, then so does the second.

One good reason for thinking that there are two such non-identical events is that they seem to differ in their causes and effects. The first event (the essentially loud event) is caused by Fred's being nervous. The second is not. Our counterfactual judgments support this conclusion. If Fred had not been nervous, the second event would still have occurred---Fred would still have said 'hello', but softly. These events also seem to differ in their effects. The second event (the accidentally loud one), but not the first, causes Barney to say 'hello' in return. For if the essentially loud event had not occurred, the accidentally loud event still might have occurred, but softly, and in that case, Barney would still have said 'hello'.

This example, and the above analysis of it, lend some support to the Essentialist Analysis. For it seems that it is the difference in the events' essential properties that allows them to differ in their effects. The reason that one event causes Barney's response and the other does not is that one possesses a certain property accidentally, whereas the other has it essentially. The property of being a saying-'hello' is causally relevant to Barney's response because it is an essential property of a cause of Barney's response; the property of being loud is not causally relevant to Barney's response, even though it is possessed by a cause of his response, because that property is not possessed essentially by that cause (or any other cause). So this example, and others, give us reason to think that the Essentialist Analysis is on the right track.²¹

6. Problems With the Essentialist Analysis

But the Essentialist Analysis is not quite right. Sometimes a cause has an essential property that is not causally relevant to its effects. The cases I know of involve modal properties, universally essential properties, "necessitated properties," and negative essential properties.²²

6.1. Modal Properties Consider Wilma's singing and its property of occurring-as-Sylvester-sneezes (Sylvester being some 20 miles away). Wilma's singing has that property contingently. But consider the property of actually-occurring-as-Sylvester sneezes. This "rigidified" property is essential to Wilma's singing.²³ So on the Essentialist Analysis the property of actually-occurring-as-Sylvester-sneezes is causally relevant to the glass's shattering. But that is counterintuitive. Obviously, any other contingent property of Wilma's singing could be "actualized" to get another essential property.

A similar problem occurs with possibility properties. Suppose that Wilma's singing does not occur as Fred coughs, but that it might have. So Wilma's singing has the property of possibly-occurring-as-Fred-coughs. Wilma's singing has that property essentially. So on the Essentialist Analysis, that property is causally relevant property to the shattering.

Let's say that if F is a property, then the properties of being possibly F, being necessarily F, and being actually F are modal properties. The above examples show that the Essentialist Analysis has problems with at least some modal properties.

6.2. Universally Essential Properties There are non-modal properties that everything has essentially. For example: being self-identical, being F-or-not-F (for any F), being such that $2 + 2$

= 4, being such that four colors are sufficient to color every map. On the Essentialist Analysis, all of these properties are causally relevant properties of every cause. But they are not.

6.3. Necessitated Properties The property of having pitch P is essential to Wilma's singing, and also (intuitively) causally relevant. But if having-pitch-P is essential to Wilma's singing, then so is the property of having-pitch-P-or-occurring-as-Sylvester-sneezes. So according to the Essentialist Analysis, this disjunctive property is a causally relevant property of Wilma's singing. In general, if F is essential to c, then so is F-or-G, for any G whatsoever---even if G is clearly not causally relevant, and even if G is not instantiated by c. So on the Essentialist Analysis, being F-or-G is causally relevant. But surely not all such disjunctive properties are causally relevant.

This disjunctive property of Wilma's singing is what I call a 'necessitated property'. Suppose that c's being F is causally relevant to e and that the Essentialist Analysis agrees: that is, c is essentially F, and c causes e. Now suppose further that it's necessary that anything that is F is also H. Then H is necessitated by an obviously causally relevant property, and qualifies as a necessitated property. By the Essentialist Analysis, H is also causally relevant to e.

Disjunctive properties are not the only troublesome necessitated properties. If Wilma's singing has pitch P essentially, then it also has the property of having some pitch essentially; and it also has the property of having some property essentially; and so on. All of these are causally relevant on the Essentialist Analysis.²⁴

6.4. Negative Essential Properties Wilma's singing is essentially a singing. It is also essentially not an explosion, not a kick, not a brown cow, not green, and not triangular. According to the

Essentialist Analysis, all of these negative properties are causally relevant to the shattering. But that is very counter-intuitive.

7. A Final Analysis

So the Essentialist Analysis is incorrect. But it is still well motivated by examples, by plausible arguments, and by plausible views concerning event causation and individuation. So perhaps all the analysis needs is an amendment that will exclude the above problematic properties. I think that there is such a way of amending the analysis. This amendment appeals to the notion of a natural property.

As a matter of fact, I will present below two amended versions of the Essentialist Analysis. The first one will be rather uninteresting, but will almost certainly exclude the problematic properties. I will then present the analysis that appeals to natural properties. Finally, I will argue that these two amended analyses are equivalent. I will later discuss the advantages and (alleged) disadvantages of appealing to the notion of a natural property in an analysis of causal relevance.

7.1. Potentially Causally Relevant Properties One way to rule out the problematic properties is to add a clause to the Essentialist Analysis requiring that F be a potentially causally relevant property. In other words, we could require that F be a property that can be causally relevant. Call the analysis that includes this requirement the 'Relevant Essentialist Analysis' (or the 'Relevant Analysis', for short). This analysis would exclude the problematic properties because none of them is potentially causally relevant (or so it seems).

Notice that the property of being a potentially causally relevant property is a one-place property (of properties), whereas the relation of causal relevance that we are analyzing is a three-place relation (among a property and two events). So the analysandum does not appear on the right hand side of the analysis, and neither does any synonym. So the analysandum and the analysans are not synonymous, and the analysis is not completely trivial. But one might nevertheless think that we now need an analysis of the notion of a potentially causally relevant property. Or if we cannot have an analysis of it, then we deserve some further explanation of it.

We could turn around and explain potential causal relevance in terms of the three-place relation of causal relevance: a property is potentially causally relevant iff it is possible for there to be events c and e such that c 's being F is causally relevant to e . This would give us a very tight circle of interdefinables---perhaps too tight to be very interesting.

We might also appeal to causal laws in order to get at least a sufficient condition for potential causal relevance. It's plausible to think that if a genuine causal law ascribes property F to causes, then F is potentially causally relevant. Perhaps this could be strengthened into a necessary condition---I consider this possibility below.

In any case, the Relevant Essentialist Analysis is disappointing, but effective in dispensing with the problematic properties.

7.2. Natural Properties We can understand the second way of ruling out the problematic properties by noticing that all of those properties seem to be a bit strange or a bit "derivative." Our expressions for referring to them are complex, and we may suspect that the properties themselves are, in some way, complex. Furthermore, and more importantly, these properties do

not seem to divide things into genuine kinds, and possession of them does not make for genuine resemblance. For instance, two things may share a disjunctive property without (intuitively) being members of the same kind and without genuinely resembling each other. Two events may share the property of being-a-singing-or-an-explosion without genuinely resembling each other. Two events (or objects) may both be not-green without resembling each other in the least.

These points hold not only for the properties mentioned in the earlier examples, but also for many others. For instance, two objects may both be shorter than the Eiffel Tower, or grue, without having anything significant in common. Two events may both be fifty miles north of a burning barn, or simultaneous with George's sneeze, or longer than World War II, without really resembling each other.²⁵

So we have strong (independent) motivation for making a distinction between those properties that make for genuine resemblance and significant kinds, and those that do not. Let's say that the properties that make for genuine resemblance, and for membership in significant kinds, are natural properties.^{26, 27}

How might this distinction help us in amending the Essentialist Analysis? I believe we can exclude the properties that raise problems for the Essentialist Analysis by requiring that a causally relevant property be natural.

(NE3) If *c* and *e* are events, and *F* is a property, then *c*'s being *F* is causally relevant to *e*

iff:

- (1) *c* is causally relevant to *e* (*c* is a cause of *e*).
- (2) *c* is essentially *F*.
- (3) *F* is a natural property.

Call this the 'Natural Essentialist Analysis' (or the 'Natural Analysis', for short).²⁸

This modification should help deal with negative properties and the problematic disjunctive properties. Negative properties and disjunctive properties are not natural, because they do not make for genuine resemblance. So these properties do not count as causally relevant on this modified account.²⁹ Similarly, many items that share universally essential properties do not genuinely resemble each other, and so these properties are neither natural nor causally relevant. The same thing goes for the troublesome modal properties.³⁰

So much for how natural properties can help the Essentialist Analysis. One might still want to know more about how we can tell whether a property is natural. Thus far I have been appealing to intuitions about genuine resemblance. Intuitions about genuine resemblance are a strong motivation for making the distinction, and they do give us a good grip on the notion. But is there some further criterion for, or explanation of, naturalness?

I believe there are rather severe limits on how far such explanations can go, because I believe that the property of naturalness is a metaphysically fundamental property of properties. But I think we can appeal to causal laws in order to state a sufficient condition for naturalness. Unnatural properties are not mentioned in any causal laws that we know of; only properties that make for genuine resemblance appear in them. So, plausibly, a sufficient condition for a property's being natural is that it be mentioned in a causal law. The causal law need not be strict, since properties that appear in ceteris paribus laws also appear to be natural.

We can now see how the Relevant Analysis and the Natural Analysis are related (and why I mentioned the Relevant Analysis first). Earlier I gave the following sufficient condition for potential causal relevance: if a causal law ascribes F to causes, then F is potentially causally

relevant. But, obviously, if a law ascribes F to causes, then the law mentions F. And if a law mentions F, then F is natural, according to the preceding paragraph. So we get an analogous sufficient condition for naturalness: if a causal law ascribes F to causes, then F is natural.

This makes the following conjecture plausible: a property is natural iff it is potentially causally relevant. If this is so, then the Relevant Analysis and the Natural Analysis are equivalent.

There is a fairly plausible argument for this conjecture by way of causal laws. Assume that if a causal law mentions F as a property of causes, then F is natural. Now assume that the converse is also true. And assume, furthermore, that a causal law mentions property F as a property of causes iff it is potentially causally relevant.³¹ Then a property is natural if and only if it is potentially causally relevant.

So the natural properties may well be all and only the potentially causally relevant properties. Thus the Relevant and Natural Analyses may well be equivalent. Since the Relevant Analysis almost certainly excludes the properties that are problematic for the Essentialist Analysis, we can conclude that the Natural Analysis does so also.³²

Thus I conclude that the Natural Essentialist Analysis provides modally necessary and sufficient conditions for the three-place relation of causal relevance. As before, we can existentially generalize on this analysis to get analyses of two-place and one-place relations of causal relevance.

8. Remarks on, and Objections to, the Natural Analysis

The Natural Essentialist Analysis ties together many subjects in metaphysics. It informs

us directly of relations between causal relevance, event causation, essential properties of events, and natural properties. It also tells us indirectly about how these are connected with genuine resemblance, event individuation, counterfactual dependence, and causal laws. So the Natural Analysis is, in that sense, highly informative. This is one of its virtues.

One might well have suspected, before looking for an analysis of causal relevance, that some of these properties and relations are closely connected. In fact, others have remarked on some of these connections (though not in discussions of three-place causal relevance). For instance, Armstrong, Lewis, and Shoemaker have maintained that the natural properties (the properties that make for genuine resemblance) are those that are potentially causally relevant.³³ And, as I mentioned earlier, some philosophers have explored the connection between the essential properties of events and their causal relations. (See notes 15 and 20.) The Natural Essentialist Analysis describes how these matters relate to three-place causal relevance for properties. So it confirms our (pre-theoretic) hunches that these connections exist. I take this to be another virtue of the Natural Analysis, and to be some confirming evidence for it.

But these very virtues may prevent the Natural Analysis from satisfying expectations that some may have for an analysis of causal relevance. For the rest of this section, I will try to anticipate some objections that may arise from these unsatisfied expectations. Abstracting away from the details, my response is that the Natural Analysis is interesting and informative even if it does not meet these expectations. Furthermore, these expectations are unreasonably high. We have no reason to think that any (correct) analysis could satisfy them.

For instance, it might be objected that the Natural Analysis has very limited usefulness, because in order to use it, one must make certain judgements about essential properties and their

naturalness, and these judgments may be as difficult to make as judgments about causal relevance itself. I agree that this may happen in some cases. But how serious an objection to the Natural Analysis is this? Some may take this to be a serious objection because of their (commonly held) expectations for such analyses. They may, for instance, expect an analysis to give us an easily applicable "decision procedure". The Natural Analysis does not. It merely(!) purports to give us an informative set of modally necessary and sufficient conditions for causal relevance. But there's little reason to think that there is an analysis of causal relevance which constitutes a "decision procedure". Moreover, the (alleged) limited usefulness of the Natural Analysis is no objection to its truth; nor does it detract from the interest of the analysis.

It's also easy to exaggerate the limits on the usefulness of the Natural Analysis. We have various (somewhat independent) judgments about event individuation, causation, essential properties, naturalness, and, finally, causal relevance. When we are more confident in our judgments regarding the former than we are in our judgments about causal relevance, then the Natural Analysis may help us form judgments concerning causal relevance. When we are more confident in our judgments about causal relevance than in our judgments about the other properties, then the Natural Analysis may serve as a guide to, or at least as a constraint on, our forming judgments about these other matters.

This first objection leads quite naturally to a second potential objection having to do with circularity, of a broadly epistemic sort. Applying the analysis (the objection goes) may easily lead us into a circle. For instance, to determine whether a property is natural, we may need to consider whether a property is mentioned by a causal law, which may lead us to ask whether that property is ever causally relevant to an effect. A similar point holds for attempts to use the

analysis to justify our judgments of causal relevance.

In fact, one might think this sort of epistemic circularity emerged earlier, before we considered natural properties. Consider Fred's saying 'hello' again. Why did I maintain that there are two 'hello's, one that is accidentally loud and another that is essentially loud? Perhaps I first judged that the loudness of Fred's 'hello' was causally irrelevant to Barney's response. So I then inferred that there must be a 'hello' that is only accidentally loud. Thus I concluded that there are two distinct 'hello's. So perhaps my judgments about the events' individuation and their essential properties were determined by my judgments about the causal relevance of certain properties to Barney's response. Wouldn't this sort of circularity occur in all attempts to use the (Natural) Essentialist Analysis?

I reply that the Natural Essentialist Analysis may lead one in a circle. But it also may not, if one has (what one takes to be) reliable judgments about event individuation, essential properties and the naturalness of those properties. Typically, one will have to "balance" one's judgments about all these matters. Again, this epistemic point does not detract from the virtues of the Natural Analysis. It does not show that the Natural Analysis is useless, or uninformative, or false. If anything, it raises the question of why we should think that the traditional requirement, that an analysis should always avoid this sort of epistemic circularity, can be satisfied.

According to a third objection, the Natural Analysis is uninformative because the above circles are "too tight". This objection is particularly wide of the mark. Firstly, as I said above, there is an obvious sense in which the Natural Essentialist Analysis is informative: it informs us of some of the relations between properties and relations like causation and naturalness. (In fact,

some may think that the Natural Analysis is so informative that it is misinformative.) Secondly, tightness of epistemic circles is not a good criterion for informativeness. Synonymy is clearly a better criterion; but the two "sides" of the Natural Analysis are not synonymous. Finally, the circles are not so tight as the objection suggests, for we have several different notions at work here. Essentiality, causation, naturalness, and causal relevance are directly involved, while others are indirectly involved.

Finally, one might be worried by what might be called a metaphysical circularity. We've seen that three-place causal relevance might be analyzed partly in terms of potential causal relevance. But one might also be able to analyze potential causal relevance in terms of the three-place relation; and perhaps we could analyze naturalness in terms of potential causal relevance. And in fact, it might be hard to avoid mentioning three-place causal relevance if one attempted to analyze naturalness or potential causal relevance. So we may have a set of "inter-analyzable" properties and relations here. But this is a sign that none of these relations is more "basic", in a metaphysical sense, than any other. Thus (one might conclude) the Natural "analysis" does not analyze causal relevance into metaphysically "more basic" properties and relations, or tell us what the three-place causal relevance relation metaphysically consists in (whatever that may mean), and so it fails as an analysis.³⁴

I agree that the "inter-analyzability" of these properties and relations is a sign that we have reached metaphysical "bedrock". But we might have suspected, even before we began looking for an analysis, that causal relevance is a metaphysically basic relation. If it is basic, then it does not "decompose", and so a traditional analysis of it is impossible. Furthermore, there is no reason (of which I am aware) to think that causal relevance is not basic, and that a more

traditional analysis is possible. But if causal relevance is basic, then the most we can hope to obtain in an analysis is information about how it is related to other metaphysically important matters. That is, the most we can hope for is an informative set of necessary and sufficient conditions for causal relevance---which is just what the Natural Essentialist Analysis is (or purports to be).

Perhaps it is misleading to call the Natural Analysis an "analysis", if it does not satisfy the traditional expectations for an analysis. However, the Natural Analysis does satisfy one traditional requirement: it is an informative set of modally necessary and sufficient conditions. If that is not enough for it to be an analysis, then we should take it be merely such a set of conditions---which is, after all, enough to make it interesting.

This ends my attempt to present and defend an analysis of causal relevance. For the remainder of this paper I criticize an alternative line of analysis, and then attempt to apply the Natural Essentialist Analysis to two cases, one involving a semantic property of a mental state.

9. On Nomological Analyses

I have suggested that there are some close connections between causal relevance and causal laws. So one might suspect that the notion of a causally relevant property can be analyzed in terms of causal laws, while entirely bypassing the Natural Essentialist Analysis. Several philosophers have offered such nomological analyses of causal relevance. Fodor (1989) proposes the following:

F is a causally relevant property if it is a causal law that F-instantiations are sufficient for G-instantiations.

But this won't do as a replacement for the Natural Essentialist Analysis for two reasons. For one thing, the analysandum is wrong. Fodor is analyzing the notion F is causally relevant, whereas the Natural Essentialist Analysis analyzes c's being F is causally relevant to e. Secondly, Fodor provides at best a sufficient condition for his analysandum.^{35, 36}

To get a nomological analysis of the three-place causal relevance relation, we need the notion of a property that is a necessary part of a set of properties that is causally sufficient for an effect. A bit more precisely: a property of a cause is causally relevant to an effect if it is a member of a minimal set of properties which is sufficient, under the laws, to bring about the effect. Still more precisely:

If c and e are events, and F is a property, then c's being F is causally relevant to e
iff

- (1) c is a cause of e.
- (2) c is F.
- (3) There is a set of true law propositions L, and one of L mentions F as a property of causes.
- (4) L, and a set of true propositions of particular fact P, together with the proposition that c occurs and is F, entail that e occurs; but L and P, together with the proposition that c occurs and is not F, do not entail that e occurs.

This is a rough, first attempt, but it is explicit enough for me to say why I am unhappy with it. First, I doubt that it is a necessary truth that all causation falls under laws. I think it is possible for there to be a cause and an effect whose causal transaction is not "covered" by a law. Perhaps

such causal transactions occur in completely lawless worlds. But even in these cases, there may be a difference between the causally relevant and causally irrelevant properties of the cause. Say that these causally relevant properties are "lawlessly causally relevant." Nomological analyses entail that lawless causal relevance is impossible. Now perhaps there are no actual lawlessly causally relevant properties. But do we want to say they are impossible?³⁷

I have a second, more specific, worry about the nomological analysis. Clause (4) requires that the laws, the proposition that c is F, and some set of particular fact propositions, together entail that e occurs. I am sure that such premises can entail that a certain kind of event occurs. But the premises can entail that e itself occurs only if they can entail some (modally) sufficient condition for an individual event e to exist. Whether they can is a hard question in the metaphysics of events. But I doubt that they can.

10. Content Properties

I will now try to apply the Natural Essentialist Analysis to two examples. I will first consider Wilma's singing. This will allow us to see that the analysis can deliver the right results, and it will give us some practice in making judgments about event individuation and causation. I then want to apply the analysis to a case involving a mental state and a mental property. In particular, I want to consider a belief and its property of expressing a certain proposition. (I am counting this content property as a mental property.) I want to argue that this property is causally relevant to some action.

In order to apply the analysis, I must make judgments about the causes of certain effects, the essential properties of those causes, and the naturalness of those properties. Though I think

my judgments (and arguments for them) are correct, one could reasonably question them, even if one accepted the Natural Essentialist Analysis. This should not be surprising. We should expect some cases to be hard and controversial, even given a plausible analysis. (Would the analysis be more plausible if it made all the hard cases easy?)

Let's turn to Wilma's singing, and its property of meaning shatter. To determine whether the singing's having this meaning is causally relevant to the glass's shattering, we must (among other things) determine whether there is an event that has that meaning essentially, and, if there is, whether it is a cause of the glass's shattering. Here is a quick summary of what I think: There is a singing which has that meaning essentially.³⁸ But no singing that has that meaning essentially is a cause of the shattering. So it is not the case that there is a singing whose possession of that semantic property is causally relevant to the shattering.

Let me elaborate and explain. There are many events occurring in Wilma's time and location when she sings. For instance, there is a singing which essentially means shatter, essentially is an utterance of 'shatter', and essentially has a certain pitch and amplitude. There is also a distinct singing event which has only the pitch and amplitude essentially. The first event could not occur without meaning shatter, whereas the second could. (The second event could also fail to be an utterance of the sound 'shatter'---it might instead be an utterance of 'matter' or 'hatter', or an utterance of some fairly similar non-English sound, like 'atter'). Call the first event the 'rich singing' since it has a rich set of essential properties; call the second event the 'poor singing'.

The poor singing (the singing that accidentally means shatter) is a cause of the shattering; the rich singing (the singing that essentially means shatter) is not. I think this is intuitively

plausible. But in any case, the following counterfactuals seem to support my view. If the rich singing had not occurred, the poor singing still might have. But if the poor singing had occurred, then the shattering would (still) have occurred. So if the rich singing had not occurred, the shattering still might have occurred. Therefore, the rich singing is not a cause of the shattering.

I think this counterfactual reasoning is strong support for my claim that the rich singing is not a cause of the shattering. But one might wonder whether the first counterfactual is true. How, one might ask, could the rich singing occur without the poor singing? And is this very "likely" to occur? Is it only a "remote" possibility, insufficient to make the counterfactual true? To use possible worlds talk: are the worlds in which the poor singing occurs without the rich singing at least as similar to actuality as those worlds in which neither occurs?

Well, just before Wilma sings, she has various intentions. Let's suppose she intends to break the glass, to impress her audience, and to pretend that she is ordering the glass to shatter. These intentions cause her to have intentions to say shatter, to utter 'shatter', and to sing with a certain pitch and amplitude. But Wilma could have sung without intending to pretend to order the glass to shatter, and so without intending to say shatter. She could merely have intended to break the glass, and thus merely intended to sing with a certain pitch and amplitude. In that case, her intention to sing at a certain pitch and amplitude would still have occurred. This intention would still have caused a sound with the same pitch and amplitude as her actual sounds. So the poor singing would still have occurred. But the rich singing would not have occurred. For Wilma's intention to say shatter is a cause of the rich singing, and the rich singing means shatter because it is caused by that intention.³⁹ So without the intention to say shatter, the sound that she produced would not mean shatter, and the rich singing would not occur.

So there are worlds in which the following occurs: Wilma intends to break the glass and impress her audience and sing with a certain pitch and amplitude, but she doesn't intend to say shatter. So the poor singing occurs but the rich singing does not. And still the glass breaks. I say that these worlds are no more remote from actuality than those in which neither the rich singing nor the poor singing occurs. (Those latter worlds are worlds in which Wilma does not sing at all, or she sings at a different pitch and amplitude.) So the counterfactual is true.

So the rich singing is not a cause of the shattering. The same goes for any other singing-event that essentially means shatter. (Similar counterfactual reasoning would apply.) So the property of meaning shatter is not causally relevant to the shattering.

Let's turn now to mental states. Suppose Wilma believes that there is champagne before her. Suppose she wishes to drink the champagne, and then does so. Her beliefs and desires have certain semantic properties or content properties: they express certain propositions. Are these properties causally relevant to her drinking the champagne? I think the answer is 'yes'.

A quick summary of my reasons: When Wilma believes that there is champagne before her, there is a mental event occurring in her that I will call a 'belief'. That event is a cause of her champagne drinking. It essentially has the property of having the propositional content that there is champagne before Wilma. That property is a natural property. So by the Natural Essentialist Analysis, the belief's having that content is causally relevant to the champagne drinking.

Now more about the details. Those who think the content property is not essential are perhaps forgetting that there may be more than one mental event involved, just as there was more than one singing involved in the previous case. I think that there is at least one belief event in Wilma that essentially has the content that there is champagne before her. That event could not

have occurred without having that content. I will call it the 'rich mental event'. But it is also plausible to hold that there is another belief-like event that has the content only accidentally. Call that the 'poor mental event'. (Whether this last event is a belief, I will not try to judge, but I am inclined to think that beliefs have their contents essentially. The poor mental event might be something like what others have called 'narrow mental states'.)

As for the naturalness of the content property: Beliefs that share the property of expressing the proposition that there is champagne before Wilma seem to be genuinely similar. Furthermore, this property seems to figure in certain (ceteris paribus) laws. For instance, anyone who believes that there is champagne before Wilma will be caused thereby to believe that there is champagne before someone. So this property seems to be natural.⁴⁰

The rich mental event (the belief that has the content essentially) is a cause of the champagne drinking. So it is correct to say that Wilma's belief that there is champagne before her causes her to drink it. It is hard to resist this judgment. And it is also supported by the following, seemingly true, counterfactual:

- (1) If the rich mental event (the essentially contentful belief) had not occurred, then the champagne drinking would not have occurred.

In more ordinary terms: if Wilma had not believed that there was champagne before her, she would not have drunk the champagne.

Now someone could question this last counterfactual, and my causal claim, in a way that is analogous with the singing case. Such an objector might reason as follows:

- (2) If the rich mental event had not occurred, then the poor mental event still might have.

Furthermore,

- (3) If the poor mental event had occurred (without the rich one), then the champagne drinking would still have occurred.

If (2) and (3) are correct, then (the objector might maintain) the rich belief is not a cause of the drinking.

I reject this reasoning because I doubt that (2) is true.⁴¹ First of all, (2) is not very plausible. It is difficult to imagine how the poor mental event could occur without the rich event. That is, it is difficult to imagine how the poor event could occur without having its actual content.

Difficult, but not impossible. I admit that it is possible for the poor event to occur without having its actual content. Imagine that Wilma grows up in a world (a "Twin Earth") where there is no champagne, but where there is a superficially similar liquid, schmampagne (which is, for instance, not made from grapes). Suppose she nevertheless is molecularly the same as she actually is, and receives all the surface stimuli she actually does. I suppose the poor mental event could occur in such a situation. Then it would not have its actual champagne content---it might instead have the propositional content that there is schmampagne before Wilma. So in this situation, the rich mental event would not occur. So it is possible for the poor mental event to occur without the rich mental event.

But all this shows is that it is possible for the antecedent and consequent of (2) to be true together. This is not enough to show that (2) is true, since the compossibility of a counterfactual's antecedent and consequent is never enough to show that it is true. For instance, it is possible that: I am not a philosopher and I live on Mars. But it is false that if I were not a

philosopher, then I might live on Mars. On the contrary, if I were not a philosopher, I would still live on Earth (working as a chemist or a plumber or whatnot). The "Martian possibility" is a possibility, but it is too "remote" to make the counterfactual true. Similarly for (2). The "Twin Earth possibility" is too remote a possibility to make (2) true. To use worlds talk: the worlds in which neither the poor nor the rich mental event occurs are more similar to actuality than those worlds in which the poor mental event occurs without its actual champagne content.⁴²

So I conclude that counterfactual (1) is true. And thus I conclude that the rich mental event (the belief that has the content essentially) causes Wilma's champagne drinking.⁴³ The content property is natural. Therefore, the Natural Essentialist Analysis entails that the content property of Wilma's belief is causally relevant to her champagne drinking.⁴⁴

Notes

1. See, for example, Block (1990), Dretske (1989), Fodor (1989), Heil and Mele (1991), Horgan (1989), Kim (1979, 1984, 1989), LePore and Loewer (1987, 1989), Segal and Sober (1991), Sosa (1984), and Yablo (1992b).

2. The events that we ordinarily call 'causes' are causes which are remarkable or salient in some way (in some context, given the reasons for thinking about causation in that context). They are causes that, for instance, are out of the ordinary, or are morally reprehensible. That is why, in most conversational contexts, we would not say that Wilma's birth is a cause of her singing, or that the window's having a certain shape is a cause of its breaking. See Lewis (1986b, pp. 214-6) for further discussion.

3. See Lewis (1986c) and Kim (1973, 1974, 1976).

4. Dretske (1989, pp. 1-2) says about this case, ". . . the fact that these sounds have a meaning is surely irrelevant to their having this effect. The glass would shatter if the sounds meant something completely different, or if they meant nothing at all."

5. Horgan's (1989) analysis of what he calls 'quausal relevance' strongly resembles LePore and Loewer's (1987), in that it is motivated by counterfactual considerations. Block (1990) seems to endorse a counterfactual analysis of causal relevance without explicitly providing one.

6. Of course, I mean some property other than existence or occurrence. LePore and Loewer (1987) fix on the first analysandum because they wish to defend Davidson against the charge of making mental properties epiphenomenal. Davidson holds something like a nomological theory of causation, and the first analysandum seems appropriate for a nomological theory of causal relevance.

7. I am indebted to correspondence with Joseph Almog and Noa Goldring in the following criticisms of the Counterfactual Analysis.

8. See the postscripts to Lewis (1973) in Lewis (1986a).

9. Horgan, and LePore and Loewer, are aware of this problem. They respond by restricting their analyses to cases that do not involve pre-emption.

The Wilma-Betty example must be modified somewhat to show that certain variants of the Counterfactual Analysis have problems with pre-emption. One variant analysis modifies the crucial counterfactual to:

If c had not been F, then c would not have caused e.

The Wilma-Betty example in the text does not constitute a counterexample to this variant. If Wilma's singing had not had the right pitch, Betty's singing would have caused the shattering--- but the counterfactual

If Wilma's singing had not had that pitch, then Wilma's singing would not have caused the shattering

is still true. Here is a counterexample to this variant analysis: Betty listens to Wilma to determine whether Wilma is singing at the right pitch to shatter the glass. Betty has decided to sing if Wilma's pitch is not correct. So if Wilma's singing had not had that pitch, it would still cause the glass to shatter, by first causing Betty to sing.

10. Horgan (1989, p. 60) is aware of the problem of closely related properties. He responds by forbidding consideration of counterfactual situations in which the cause has a property that is (1) of the same "general type" as the actual property, and (2) is causally relevant "in essentially the same way." Horgan realizes that this exclusion makes his analysis circular, but he does not try to break out of the circle.

11. Notice that "instantiations" of these negative properties are (usually) not sufficient for the occurrence of an event that is a genuine cause of the effect. For instance: there is some air where a soundproof wall might have been. The presence of air is a genuine cause of the shattering. One might initially think that the absence of a soundproof wall is the same as the presence of air in that spot. This might lead one to think that the property of not-being-located-near-a-soundproof-wall is causally relevant to the shattering. But the presence of air and the absence of a soundproof wall are not the same---the absence of the wall would "occur" if there were no air at all, or if there were a blanket where there is actually air, or if there were a sound-generating machine where there is actually air, and so on.

12. The universal properties mentioned below are different sorts of properties, and may raise

problems for different reasons. One might refuse to recognize some of them as properties. I agree with this reaction to this extent: we must distinguish between these rather un-natural properties and others in order to distinguish between causally relevant and irrelevant properties. See section 7.

13. One might suspect that this example does not satisfy clause (4) of the Counterfactual Analysis. But it does. The proposition that Wilma's singing is such-that-some-object-exists-at-t' does not logically or metaphysically entail that the shattering occurs. Also, the proposition that the shattering occurs (at t') does not entail that Wilma's singing occurs; thus it does not entail that Wilma's singing has the above property. We can construct further counterexamples of the same sort by finding propositions entailed by the proposition that e occurs, but which do not entail that Wilma's singing occurs. For instance, that the shattering occurs metaphysically entails that some glass exists at some time or other. But this latter proposition does not entail that Wilma's singing occurs. So by the Counterfactual Analysis, the singing's having the property of being-such-that-some-glass-exists-at-some-time is causally relevant to the shattering.

14. I assume that the "right to left" direction of (E) is uncontroversial: if c is a cause of e, then c is causally relevant to e. But some might reject the converse, that is, some might maintain that an event may be causally relevant to e, and yet not be a cause of e. Yablo (1992b, pp. 273-4) may hold this view. I cannot review all the different reasons one might have for holding this view. But one possible reason is this: one might think that a real cause must not only be causally relevant to an effect, but must also be causally sufficient (or nearly so) for the effect. I reject this

reason, because many events that we judge to be causes are nowhere close to being causally sufficient. In any case, I accept (E), and I assume it in my analyses. Someone who rejects (E) could still accept my analyses of causal relevance for properties, by ignoring the remarks that assume (E) and substituting her preferred analysis (if any) of causal relevance between events.

15. Lewis (1973, 1986c) and Yablo (1992a, 1992b) also see many connections between the essential properties of events and their causal properties.

16. To be precise, the counterfactual "If c had not had that property, then e would not have occurred" is ambiguous, and will be vacuously true on only one reading.

- (1) If it were the case that (c occurs and is not F), then it would not be the case that e occurs.
- (2) If it were not the case that (c occurs and is F), then it would not be the case that e occurs.

The difference is in the scope of the negation in the antecedent. Suppose F is essential to c. Then the antecedent of (1) is false in every world because there is no world where c occurs and is not F. So it is impossible, and (1) is vacuously true. But there are worlds where c does not occur. In those worlds, the antecedent of (2) is true. So the antecedent of (2) is possible, and (2) is not vacuously true.

Nevertheless, (2) will almost always be true if the Essentialist Analysis says that c's being F is causally relevant to e. For then F is essential to c, and so the second counterfactual is equivalent to

(3) If it were not the case that *c* occurs, then it would not be the case that *e* occurs.

This counterfactual is true if *c* causes *e*, if there is no pre-emption or redundant causation going on. But *c* does cause *e*, if *c*'s being *F* is causally relevant to *e*.

The counterfactual in the Counterfactual Analysis has the form of (2) above. But the counterfactuals we appeal to when thinking about causal relevance informally often seem to have the form of (1). I have been using both freely. In most cases, this makes no difference.

17. Horgan (1989) realizes that according to some counterfactual analyses of causal relevance, any essential property of a cause will be causally relevant to its effects. Horgan thinks that this is undesirable, but he does not say why. In response to this "problem," Horgan replaces the counterfactual analysis with an analysis that talks explicitly about pertinently similar events (roughly, counterparts) in pertinently similar worlds.

18. Some might argue that the "law properties" I mention in section 3.4 are essential to Wilma's singing. For they may think that the laws of nature are necessary. Or they may think that an actual event could not occur in a world where the natural laws are different from the actual laws. I reject both claims, and I furthermore think Wilma's singing could occur in a world with different laws. Imagine a world in which forces, masses and accelerations satisfy ' $F=ma$ ' up until Wilma sings. A millisecond after she sings, they begin to satisfy the equation ' $F=ma^{1.01}$ '. So our laws don't hold at that world. But (it seems to me) Wilma's actual singing occurs there. If I am wrong about this, and the law properties are essential to Wilma's singing, then I cannot exclude them until I have the Natural Analysis at hand. (The Natural Analysis excludes law properties

because they are not natural properties.)

19. The analysis of "F is causally relevant to e" (analysis (E2)) has a consequence which some may find strange. Every actual event e has a long causal history. The events in that history are all causes of e. So on (E2), the essential properties of events in that history count as causally relevant to e. For instance, the Big Bang is a cause of the glass's shattering. If the property of having an extremely high temperature is an essential property of the Big Bang, then that property is causally relevant to the shattering. I think this last claim is as acceptable as the claim that the Big Bang is a cause of the shattering. We could, if we wish, try to distinguish between an event's direct causes, and its indirect causes. If we did so, we could make a similar distinction between direct and indirect causal relevance. The property of having extremely high temperature would then be only indirectly causally relevant.

One might also think that the analysis of "F is a causally relevant property" is too restrictive. Couldn't there be a property which is causally relevant but which has never actually been instantiated? Or one which has been instantiated, but never by a cause of another event? I prefer to call such a property 'causally potent' or (better) 'potentially causally relevant'. See section 7 for more on this property.

20. I have borrowed the following example from Goldman (1971, p. 3) and Lewis (1986c). I follow Lewis, for the most part, in my analysis of the example.

21. Some apparent counterexamples to the Essentialist Analysis can be "turned aside" if we keep

in mind that two events with different essential properties can occur in the same place and time. For instance, suppose Wilma sings at exactly 80 decibels, and this causes a needle in a sound-level meter to point at exactly '80'. The exact amplitude of Wilma's singing seems to be causally relevant to the needle's pointing at exactly '80'. Yet one might think that the exact amplitude is not essential to Wilma's singing---it could have occurred and been only 78 decibels, for instance. So one might conclude that according to the Essentialist Analysis, the exact amplitude of Wilma's singing is not causally relevant to the pointing. But there are (arguably) at least two events occurring as Wilma sings. One occurs essentially at exactly 80 decibels. The other occurs only accidentally at exactly 80 decibels; it could have occurred at 78 decibels. (The first necessitates the second.) The first event's being exactly 80 decibels is causally relevant to the pointing according to (E3). So by (E2) the property of being at exactly 80 decibels is causally relevant to the pointing.

22. The following examples also raise problems for the Counterfactual Analysis, and for any counterfactual analysis that does not require that the relevant counterfactual be non-vacuously true.

23. Here is why, using possible worlds talk: in any possible world where the singing exists, that singing has the property of occurring-in-the-actual-world-at-the-time-that-Sylvester-sneezes.

24. Second-order, existential properties may, in some sense, be disjunctive. I will not attempt to determine this here. The above examples seem quite powerful, but I am not entirely sure that

they are successful. The intuition that these properties are causally irrelevant may be due to the (accurate) judgment that these properties are not usually causally sufficient.

25. See Kim (1973, 1974, & 1976), Geach (1969), and Shoemaker (1984) for discussion and further examples.

26. Strictly speaking, naturalness, as I will think of it here, is not an all-or-nothing affair. Some properties are more natural than others. So naturalness is a matter of degree. For instance, a property that is a disjunct of two (quite different) properties is less natural than its disjuncts, but more natural than a disjunction of infinitely many varied disjuncts. But some properties are sufficiently unnatural to be labeled as plain 'unnatural'. The properties that I claim in the text are not natural are, strictly speaking, not natural enough.

My distinction, and my arguments in favor of it, are strongly influenced by Kim, Shoemaker and especially Lewis (see previous note). I have chosen to use Lewis's term 'natural' (because it seems natural), but I strongly suspect that the notion I have in mind is not the same as Lewis's. (It may be closer to Shoemaker's and Kim's.) Lewis wants the perfectly, or maximally, natural properties to be intrinsic. I am not sure that the maximally natural properties in my sense are intrinsic. In any case, I want some extrinsic, or relational, properties to be natural enough to be causally relevant. Lewis also holds that only the fundamental properties of physics are perfectly natural. I do not know whether this holds for the notion I have in mind, but in any case, I want non-fundamental properties to be natural enough to be causally relevant.

27. Both objects and events have natural properties. For instance, being-two-inches-in-diameter is a natural property of objects; being-a-collision is a natural property of events. There are difficult questions about how these are related. Suppose, for instance, that a rock has the natural property of being-two-inches-in-diameter. If the rock is involved in a collision, then the collision will have the property of being-a-collision-with-an-object-2-inches-in-diameter. Is this a natural property of the event? I am inclined to say 'yes', for there seems to be a genuine similarity between collisions involving 2-inch-wide objects (and a genuine dissimilarity between those events and collisions involving 2-mile-wide objects). But I hesitate to endorse a general principle, such as "if a property of an object involved in an event is natural, then the 'corresponding' property of the event is also natural." In any case, I am concerned here with the natural properties of events, whether or not these are "inherited" from objects' natural properties.

28. Since naturalness comes in degrees, perhaps the amendment should explicitly mention degrees of naturalness. Perhaps we should develop a theory of degrees of naturalness, and then replace (3) with "F is natural to degree D or greater." Alternatively, perhaps causal relevance itself should be viewed as a matter of degree. Suppose c causes e, and c is both essentially F and essentially G. Suppose also that F is more natural than G. Then perhaps F is causally relevant to e to a greater degree than G. I must, however, leave these intriguing possibilities aside.

29. But some necessitated properties, including some disjunctive and existential properties, may be natural (enough). Consider, for instance the property of being-exactly-60-decibels-or-between-60-and-62-decibels, and the property of having-some-pitch-between-440-and-442-Hz.

30. The universally essential properties are not natural because they do not divide objects into genuine kinds. The same goes for many possibility properties, but perhaps not all. Consider the property of being-possibly-a-sound. Perhaps only sounds can have this property, and so perhaps all events that have this property will genuinely resemble each other. Some actuality and necessity properties may also be natural, for example, actually-having-pitch-P. So perhaps we should say this: the properties of being-actually-F and being-necessarily-F are natural iff F is. (This principle won't work with possibility properties: being-green may be natural, but not being-possibly-green.)

31. Are there potentially causally relevant properties that are not mentioned by laws? I believe that "in the actual world", every potentially causally relevant property that is instantiated is mentioned in some law. But perhaps "in other worlds" there are potentially causally relevant properties that are instantiated but not mentioned by laws. This might happen in worlds where some causation is lawless. If this is possible, then the argument in the text for the equivalence of the Natural and Relevance Analysis shows only a material, not a modal, equivalence. See section 9.

32. There may be yet another way of amending the Essentialist Analysis to yield an analysis equivalent to the Relevant and Natural Analyses. This amendment appeals to the idea that some essential properties of an object are (what I will call) constitutive, whereas other are not. For instance, I am essentially red-or-not-red, and also essentially human, but only the latter is a constitutive property of me. The problematic properties of Wilma's singing are not constitutive

properties of the singing. So perhaps an amendment to the Essentialist Analysis that excluded non-constitutive properties would exclude causally irrelevant properties. (This appeal to constitutive properties is inspired by Almog's [1991] account of primal traits; see Fine [1994] for a similar notion.)

33. I am stating their views using my own vocabulary, at the risk of distorting their views.

Armstrong (1978) uses the term 'universal' in much the same way that I use 'natural property'.

Armstrong (1978 2: pp. 44-5) says that every universal bestows some causal power upon the particulars that instantiate it, and that the causal powers of a particular are determined by the universals it instantiates. This amounts to the claim that all, and only, the natural properties of an object determine its causal powers. And that seems to entail that all and only the natural properties are potentially causally relevant. Lewis agrees with Armstrong on the connection between naturalness and causal powers. He says (1983, p. 347), "Natural properties [are] the ones whose sharing makes for resemblance, and the ones relevant to causal powers."

Shoemaker's (1984) distinction between "real" and "mere-Cambridge" properties corresponds roughly to my distinction between natural and unnatural properties. (But Shoemaker's real properties are properties of objects, not events.) Shoemaker says (1984, p. 212) that two real properties are identical iff they make the same contribution to the causal powers of things that have them. He also says (1984, p. 214) that all real properties make some contribution to the causal powers of things that have them. Together, these seem to entail that all real, or natural, properties are potentially causally relevant. If we suppose that any property that does contribute to objects' causal powers is real (in Shoemaker's sense), then we end up again with the view that

all and only natural properties are potentially causally relevant.

34. The objection supposes that a putative "analysis" may provide a set of modally necessary and sufficient conditions for items' bearing a relation, and yet not tell us "what the relation is". So it seems to presuppose that two relations can be necessarily co-extensive without being identical. This seems correct: the universally essential properties I mentioned earlier are necessarily co-extensive, but seem to be distinct.

35. Fodor's sufficient condition is also too stringent to be illuminating. For on his analysis, a property is not counted as causally relevant unless it is causally sufficient for occurrences of another property. But there seem to be properties that are causally relevant but which are not causally sufficient in this sense. For instance, having-amplitude-A is causally relevant to the shattering. But it is unclear whether having that property is causally sufficient for any other sort of event. It is not causally sufficient for glass shatterings (for a certain pitch is also needed), or even sound-level meter readings (for certain conditions must hold inside the sound-level meter). Perhaps Fodor would nevertheless maintain that there is a causal law that says that sounds with amplitude A cause glass breakings, but it's a law that is very "ceteris-paribus-y". (Thanks to Lynne Baker for discussion of this.)

36. Segal and Sober (1991) have also proposed a nomological analysis of causal relevance. It builds various conditions on top of Fodor's, to obtain a sufficient condition for the one-place property of being a causally relevant (efficacious) property. Segal and Sober's proposal,

however, seems to presuppose a three-place relation of causal relevance for microphysical events. (See their [1991], p. 10, clause (ii) of (P4).) So they may intend to give a sufficient condition for causal relevance for macroscopic properties only. Thus they may intend their proposal to have a more limited scope than Fodor's.

37. If all actual causal transactions are governed by causal laws, then perhaps a nomological analysis gives a materially necessary and sufficient condition for causal relevance. But then nomological analyses must count ceteris paribus laws as real laws, or else they will count too few properties as causally relevant.

38. I am occasionally inclined to think that there is no singing event that means shatter essentially. If there is not, then there is no need to go any further---the Natural Essentialist Analysis entails that the meaning property is not causally relevant to the shattering.

39. To see this, suppose that Wilma's singings sound like the German noun 'Schatten', which means (roughly) shadow. Clearly her singings do not mean shadow just because they happen to sound like a German word with this meaning. Similarly, if Wilma does not intend to say shatter, then her singings do not mean shatter, even if her singings sound like an English word that means shatter.

40. I do more to defend the view that content properties figure in ceteris paribus causal laws in Braun (1991). "Twin Earth" cases show that content properties of mental events are determined

by their relational properties. Nevertheless, I think they are natural enough to be causally relevant. This may show that my notion of naturalness is from different from Lewis's (1983) notion. See note 26.

41. My argument in the next four paragraphs resembles arguments given by Horgan (1989, pp. 61-3) and Heil and Mele (1991, pp. 68-9) when they consider whether Twin Earth cases show that content is causally irrelevant.

42. I also doubt that counterfactual (3) is true. As I say in the main text, it is possible for the poor mental event to occur without the rich mental event. Let's suppose that it is also possible for the actual champagne drinking to occur in some such cases. Nevertheless, it is "unlikely" that the actual token champagne drinking would occur in such a case. And it is at least as "likely" that a schmampagne drinking would occur instead. That is, it is at least as "likely" that Wilma would drink schmampagne as a consequence of having a schmampagne belief. In possible worlds talk: the worlds in which Wilma has a schmampagne belief and drinks schmampagne are at least as similar to actuality as the worlds in which she has a schmampagne belief and her actual champagne drinking occurs. Therefore (3) is false.

43. The poor mental event is also (arguably) a cause of Wilma's behavior, for if it had not occurred, Wilma's behavior would not have occurred. So the poor mental event and the rich mental event are distinct causes of Wilma's behavior, occurring at the same place and time. I believe this conclusion is correct, but it raises various issues, some of which are discussed by

Kim (1989) and Yablo (1992b).

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