Causation

Does stuff just happen?







"What do you mean 'it just happened'? Didn't we discuss cause and effect?"



 The intuitive idea of cause and effect is that some objects and events "come from", or "are produced by" other objects and events.

E.g. (one of Anscombe's favourites)



Hume's empiricism

1. Ideas vs. Impressions

So we can divide the mind's perceptions into two classes, on the basis of their different degrees of force and liveliness. The less forcible and lively are commonly called ... 'ideas'. The others [I will call] 'impressions' ... By the term 'impression', then, I mean all our more lively perceptions when we hear or see or feel or love or hate or desire or will. These are to be distinguished from ideas, which are the fainter perceptions of which we are conscious

when we reflect on our impressions. (Enquiry, Section 2)

1. Ideas vs. Impressions

"all our ideas or more feeble perceptions are copies of our impressions or more lively ones."

Arguments for empiricism

- 1. When we analyse our thoughts or ideas—however complex or elevated they are—we always find them to be made up of simple ideas that were copied from earlier feelings or sensations.
- 2. If a man can't have some kind of sensation because there is something wrong with his eyes, ears etc., he will never be found to have corresponding ideas.

(Enquiry, Section 2)

What about cause and effect?

- The concept of cause and effect is a tricky one for Hume, on account of his commitment to empiricism.
 When we observe a causal process, what exactly do we see?
- We don't see any 'force', or 'power', or 'ontological dependence'. We don't see that the effect 'came from' or 'derived from', or 'is necessitated by', or 'owes its existence to' the cause.
 - So these can't be part of our concept of cause

What about cause and effect?

- What we *do* experience, Hume says, are:
 - The cause and effect are contiguous (in space and time).
 - The cause is **prior to** the effect in time.
 - There is a necessary connection between cause and effect.
- But how do we experience a necessary connection?

The idea of necessary connection

- Of course if we just see one case of causation (e.g. one ball striking another) then we don't get any impression of a necessary connection between the two.
- We get a sense that the connection is necessary only when we see the same thing happen **over and over again**, under the same conditions.
- "If all we ever saw were particular conjunctions of objects, each conjoined pair being entirely different from each of the others, we could never form any such ideas. But when we observe **numerous instances** in which the same kinds of objects are conjoined, we immediately conceive a connection between them ..." (*Treatise* reading, pp. 5-6)

A puzzle

- But how can mere repetition of the *same* (type of) impression give rise to a fundamentally *new* idea?
- Certainly, seeing the same type of object (e.g. a red tomato) over and over again cannot give us any new idea *about the tomato*.
- "Nothing new is either revealed or produced in any objects by their constant conjunction, and by the uninterrupted resemblance of their relations of succession and contiguity. Yet it is from this resemblance that the ideas of necessity, of power, and of efficacy are derived. So these ideas don't represent anything that does or can belong to the objects that are constantly conjoined." (Treatise reading, p. 7)

The solution

- For whatever reason, the mind has an instinctive tendency to expect nature to be uniform in certain respects.
- Suppose we see the 'constant conjunction': A ... B, etc. many times.
- After a while, we expect or 'infer' that B will occur, soon after we see A.
- The idea of necessity is derived from this *internal* impression, the impression *in our own mind* of *expecting* the usual succeeding event.

- Similar to Pavlov's dogs expecting meat, after hearing a bell ring.
 - (Or guinea pigs expecting food after clapping.)



- The only internal impression that has anything to do with the present business is the impression of the propensity that custom produces in us to pass from an object to the idea of its usual attendant. This, therefore, is the essence of necessity. The bottom line is this: necessity is something that exists in the mind, not in objects, and we can't ever form the remotest idea of it considered as a quality in bodies
- (Hume, Treatise, p. 9 in the reading.)

Another case of projection?

- It is widely recognized that the mind has a great propensity to spread itself on external objects ...
- For example, as certain sounds and smells are always found to accompany certain visible objects, we naturally imagine that the sounds and smells are in the objects, even being in the same place, though in fact the qualities are the wrong sorts of thing to be conjoined with objects, and really don't exist in any place.
- All I need say here is that this propensity that the mind has for spreading itself on external objects is what makes us suppose necessity and power to lie in the objects we consider, not in our mind that considers them. . . .

Is this crazy?

- "I am aware that this is the most violent of all the paradoxes that I have advanced or will advance in the course of this *Treatise* ..." (p. 9)
- "Each of these definitions brings in something that lies right outside the cause itself, because definition (1) brings in earlier events similar to the cause, while (2) brings in events in the mind of the speaker; but there's no remedy for this drawback. We can't replace those definitions by a more perfect one that picks out something in the cause itself that connects it with its effect. We have no idea of this connection; nor even any clear notion of what we are aiming at when we try to form a conception of it." (*Enquiry*, Section 7, Part II)

- In other words, Hume can make no sense of causation as a relation that exists in the 'single case", i.e. a relation between a particular pair of events.
- If you reject this too for the same reason—because in addition to the cause and the effect it brings something extraneous (namely our impressions and ideas of them)—I can only ask you to replace it by a better definition. I have to admit that I can't do that.

(Hume, Treatise reading, p. 11)

'Regularity theory' of causation

- Hume's theory of causation is known as a 'regularity theory', because it defines causation in terms of a regular, or invariable, pattern of succession.
- *All* theories accept that there are many regularities in the world, and that they have something to do with cause and effect.
 - But regularity theories make regularities the *fundamental fact* about causation.

- 1. The need for explanation.
 - We are likely to ask things like: Why do magnets always attract iron nails, but not copper nails?
 - Are we satisfied by the answer: "because there is a regularity that magnets attract iron ..."
 - Surely this puts the cart before the horse?
 Doesn't the regularity exist because the nature of iron and magnets *produces* an attraction?

- 2. Why is the cause *prior to* the effect?
 - It seems that the priority of the cause to the effect is an important feature of the world, something to be explained. (E.g. photos of a wedding never exist before the wedding!)
 - But for a regularity theory what can be said?
 - (Is it just a linguistic convention, like sailing terminology?)

- 3. Regularities due to common cause:
 - Two distinct events may occur with regular succession if they are effects of the same cause.
 - E.g. thunder and lightning are two effects (audible and visible) of an electrical discharge.
 - Lightning and thunder seem to be cause and effect, according to Hume's definition. But they aren't really.
 - (Similar examples abound, e.g. a rapid drop of a barometer needle, and stormy weather.)

- 4. Irregular causation
 - There are many cases where one particular event is believed to have caused another, even though there is no regular pattern.
 - E.g. the two events may be unique, like an outcome of a very unusual experiment that was performed only once.
 - Or, the succession may occur with a reliable relative frequency that is less than 1 (e.g. die rolls, catching a disease following exposure).

Elizabeth Anscombe

- According to Anscombe, Hume's theory of causation commits two key mistakes.
 Contrary to Hume, Anscombe claims:
 - Causation doesn't imply necessitation. A can cause B, without necessitating B.
 - Necessity itself is *logical consequence*, relative to the laws of physics, not a subjective relation that only exists in our minds.

"... it is often thought that probabilistic causation is the only alternative to deterministic causation."

"Contemporary libertarians often point to Anscombe and in particular to C&D as an inspiration for their account of free will [in terms of probabilistic causation]. But, as I hope to have shown, the widespread acceptance of probabilistic accounts of the causation of action among contemporary libertarians actually is in conflict with her outlook. Moreover, I have argued that there indeed are good reasons (which I derived from Anscombe) for rejecting such probabilistic analyses ..."

 Niels van Miltenburg, Synthese, volume 200, Article number: 279 (2022)

- "causality consists in the derivativeness of an effect from its causes. This is the core, the common feature, of causality in its various kinds. Effects derive from, arise out of, come of, their causes. For example, everyone will grant that physical parenthood is a causal relation. Here the derivation is material, by fission. Now analysis in terms of necessity or universality does not tell us of this derivedness of the effect; rather it forgets about that. For the necessity will be that of laws of nature; through it we shall be able to derive knowledge of the effect from knowledge of the cause, or vice versa, but that does not show us the cause as source of the effect. Causation, then, is not to be identified with necessitation."
- (Anscombe reading, p. 6)

N.B. Hume on 'production'

- You might want to stop looking at particular cases and define 'cause' as 'something that is productive of something else'; but this doesn't say anything. For what would you mean by 'production'? Could you define it except in terms of causation? If you can, please produce the definition. If you can't, you are here going in a circle, producing merely one synonymous term instead of a definition. (Hume, *Treatise*)
 - Can we say the same about for "effects derive from their causes"?
- Anscombe's point is that 'derivedness', (and 'source of', 'arise out of', etc.) whatever it does mean, is clearly not a *logical* relation – it's not logical consequence.
 - It's an ontological relation? (Ontological dependence)

What is a 'logical consequence'?

- The most fundamental logical relation is *logical consequence*.
 - Logical consequence is a relation between propositions, or possible states of affairs.
 - 'A entails B', 'A \Rightarrow B', 'B follows from A', 'B is a logical consequence of A' all mean the same thing.
 - If $A \Rightarrow B$, then a perfectly rational being (like Laplace's demon) will infer B from A.
 - If A \Rightarrow B, then B is true in all the possible worlds where A is true.
 - A valid argument is one whose conclusion is a logical consequence of the premises.

What is a 'logical consequence'?

- Logical consequence is closely tied to *epistemic* necessity.
 - "… a proposition P is *epistemically necessary for an agent* A just in case the empirical evidence A possesses and ideal reasoning (i.e., reasoning unrestricted by cognitive limitations) are sufficient to rule out ~P."
 - ("Varieties of Modality", Stanford Encyclopedia of Philosophy)
- **Summary**: Logical consequence is a relation between abstract entities (propositions, or states of affairs) that is normative for rational inference.

Hume: causation *isn't* logical consequence

"It was this last view [Hobbes], where the connection between cause and effect is evidently seen as *logical* connection of some sort, that was overthrown by Hume, the most influential of all philosophers on this subject in the English-speaking and allied schools. For he made us see that, given any particular cause – or 'total causal situation' for that matter – and its effect, **there is not in general any contradiction in supposing the one to occur and the other not to occur**." (Anscombe, C&D)

- However, Hume does regard 'necessary connection' as the core of causation.
 - (Is 'necessary connection' a logical relation?)

Is necessitation a logical relation?

- Hume, as we've seen, gives a *psychological* analysis of 'necessary connection', not a logical one.
 - But that's very non-standard, to say the least.
- The standard view is that 'necessity', as used in the context of causation – often called *nomic* necessity – reduces to logical consequence.
- 'A determines (necessitates) B means:
 - B is a logical consequence of A, together with the laws of physics.
 - I.e. (A & Laws) \Rightarrow B.

What are laws of nature?

- Is there a *logical contradiction* in believing that something can move faster than light in a vacuum, or that electrons attract each other?
 - Surely not! (Hume is right about that.)
- In what sense are the laws of physics themselves necessary then?
 - There are different views about this.
 - My own view is that physical entities possess certain causal powers essentially, and the laws of physics follow logically from those powers.

Just metaphors?

- Here Anscombe contrasts the necessitation relation with ontological dependence ('derivedness', or 'being the source of', the 'origin' of, etc.)
- Causation is all about the latter, she says, and has nothing to do with the former. (Some causation might well be necessary, but then the necessity is something *in addition to* the causal relation.)
 - But this 'derivedness' relation is a bit unclear, isn't it?
 - Is the metaphor of 'coming from' in the literal sense of travel helpful here?
 - What about the metaphor of *support*? Or an infectious disease?

Example: Feynman's bomb

Suppose someone connects a bomb to a Geiger counter, in such a way that if the count rate exceeds a certain threshold, the bomb will go off. Fortunately, this threshold is well above the background radiation, so the bomb isn't likely to go off any time soon. Then Fred, in a mischievous mood, throws a piece of uranium at the Geiger counter, so that it lands right next to it. Immediately the bomb goes off.

Feynman's bomb

- The following claims, concerning this story, both seem to be true.
- 1. The particles that triggered the explosion *came from* the chunk of uranium.
- 2. The throwing of the uranium *did not guarantee* that the bomb would go off. (Because nuclear decay is random and unpredictable, the chance of the bomb exploding increased a lot, but only to 0.9 perhaps.)

- Thus Feynman's bomb seems to show that we can at least make sense of causation without determination.
 - (Or can we? Maybe the whole thing strikes you as impossible?)
- E.g. you might say that if individual nuclear decays are random (= indeterministic) then they must also be uncaused. And then Fred's throwing the uranium didn't cause the explosion?
- Indeterministic causation seems mysterious and fishy?

Cause = chance raiser ?

("probabilistic causation")

- In medicine, researchers are very interested in finding out what the effects of a given treatment are.
 Does the medicine work?
- What's the best way to test the efficacy of a drug?
- The 'gold standard' is the double-blind randomized experimental study.
- This tests whether taking the drug *increases the chance* of a happy outcome, and such chance increases are called 'causation'.

Smoking and cancer

- E.g. when medics say that "smoking causes cancer", they mean that *smoking increases a person's chance of getting cancer*.
- Note that chance-raising is something that exists even in an indeterministic world, so here is a way to make sense of indeterministic causation.
- Ramachandran: "If we want to allow that there is causation even in indeterministic worlds, there is little alternative but to take causation as involving chance-raising."*

* "Indeterministic causation and varieties of chance-raising". In P. Dowe and P. Noordhof (eds.), *Cause and Chance* (Routledge, 2003) 152-62.

Problems for probabilistic theories

- Theories that analyse causation in terms of chanceraising are called "probabilistic theories of causation".
- E.g. "C caused E" means that the occurrence of C would raise the probability of E.

• They face some problems that seem serious.

Problems for probabilistic theories

- 1. You can raise the chance of en event, without that event happening.
 - E.g. you smoke for 20 years, but never get cancer.
 - But, as Anscombe says, "a thing hasn't been caused until it has happened".
- Solution?
- Add the actual occurrence of E to the analysis! (And the occurrence of C as well.)

• E.g. "C caused E" means that:

- 1. C occurred
- 2. E occurred
- 3. The occurrence of C would raise the probability of E.

Problems for probabilistic theories

- 2. Chances are often raised by events that are not causes.
- "... suppose that two gunmen shoot at a target. Each has a certain probability of hitting, and a certain probability of missing. Assume that none of the probabilities are one or zero. As a matter of fact, the first gunman hits, and the second gunman misses. Nonetheless, the second gunman did fire, and by firing, increased the probability that the target would be hit, which it was. While it is obviously wrong to say that the second gunman's shot caused the target to be hit, it would seem that a probabilistic theory of causation is committed to this consequence"

(SEP, "Probabilistic Causation", 2.10.)

Problems for probabilistic theories

- 3. Some causes actually *lower* the chance of the effect.
- E.g. a soccer team is down 1-0 with ten minutes to play. In a moment of madness, the coach takes off his best striker, replacing him with a defender, thus lowering the chance of an equalising goal. Against the odds, however, that defender scores a goal.

Another case

- Jim has a very severe bacterial infection, so that he's in grave danger. Untreated, the infection has a 60% chance of killing him. Jim's desperate doctors decide to give him a massive dose of a powerful intravenous antibiotic. This antibiotic is for extreme circumstances only, as there's a 10% chance that the antibiotic itself will kill the patient. That's what happens in Jim's case. The infection is dealt with, but as an unfortunate "side effect" Jim dies.
- Did giving Jim the antibiotic *cause* him to die?

Another case



• Birth control pills can cause thrombosis, while lowering the chance of it.

Problems for probabilistic theories

4. Is there really causation by omission?

Dr. Bob: I saved the lives of 6 patients this week.

Nurse: By operating?

Dr. Bob: No, by not operating.



Problems for probabilistic theories

- 5. Is there really causation by double prevention?
- Suppose Fred is injured in a car accident, and bleeding out. Fortunately an ambulance is on its way, and is expected to arrive in time to save his life. But then – another disaster – the ambulance gets a flat tire. There's a delay. Fred dies.
 - Did the flat tire *cause* Fred's death?
 - The two events aren't even physically connected!

- It sometimes seems that one object acts on another that is at a distance from it, but they are commonly found on examination to be linked by a chain of causes, with each link contiguous to the next, and the end links contiguous to the distant objects; and in any particular case where we can't discover such a chain we still presume it to exist. (Hume, *Treatise*, p. 2)
- (There's *no such chain* here between the tire going flat and Fred's death. But still the tire going flat raises the chance that Fred will die.)

• What do we think about probabilistic theories of causation?

Causation and real existence

- Last week we puzzled about what is required to give an object 'real existence', i.e. existence as a concrete particular, not a mere bundle of concepts.
- I think it's important to note that really-existent entities are always spatio-temporally connected to other concrete (really existent) things, through what we call 'causal processes'.
 - E.g. if a window breaks, then we think there was something in its neighbourhood, like a moving rock, that caused it to break.

Causation and real existence

- Imagine Leibniz's God, right after he has identified the *best* of all the possible worlds.
- God now knows which world he wants, but so far the world in queston is abstract, just a very complicated thought.
- How does he make that world concrete?
- I want to suggest that he only has to render the *initial moment* of the world concrete. For that moment 'concretises' the next moment, which concretises the next one, and so on. Concreteness spreads through the world by itself, like falling dominoes.
- Causation *is* the transmission of real existence through spacetime.

An analogy



Causation and real existence

- On this view, chance-raising is a real and important aspect of the world. But it isn't *causation* as such.
 - Or at least it isn't the *only* thing we call 'causation'.
- Chance-raising is closely connected to determination, since a chance is a *degree of determination*.
 - If an event has a chance of 1, then it is pre-determined.
 - With lower chances, the event is determined to some extent.
- Causation proper isn't linked to determination at all. Determination has nothing to do with real existence.