University of Oxford Department of Politics

Philosophy of the Social Sciences: Lectures
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Lecture 2: <u>**EXPLANATION II** –</u>
the realist critique of causal explanation

<u>The Problem</u>

Philosophers have had the utmost difficulty in arriving at an operationalisable philosophical analysis of the difference between a genuine 'cause' and an 'accidentally true generalisation' or simple empirical association. Yet in social science we need to know whether one factor really is the cause of another.

<u>Summary</u>

1.   Problems with Hempel's model:
        Logical entailment between premisses and conclusion of an argument is not explanation;
        Prediction is not explanation.
        For an explanans to really explain the explanandum we seem to require a causal connection between the two.

2.   Hume.
        Denies the rationality of our belief in any necessary connection between events in the world that we take to be causally connected; this belief is not based upon experienced facts; nor is it based upon logical deduction. It is psychological. The analysis of cause addresses the question: 'when do we believe that two events are causally connected?'

3.   Mackie.
3.1.   The idea of a field of background and counterfactual conditions. In causal analysis we set this aside.
3.2.   INUS cause: The cause of an event, state of affairs, or phenomenon, can be 'an Insufficient, but Non-redundant, Unnecessary part of a Sufficient condition for the event ... to occur'.
3.3.   Mackie's account emphasises a certain indeterminacy in causation.

4.   Realism.
        Shift from analysis in terms of events (discrete), to anlaysis in terms of processes (non-discrete).
eg: The brick hits the glass; the window breaks. Or: The brick's hitting the glass at such and such a velocity, force and angle is disrupting the molecular structure of the glass such that it shatters.

5.   Salmon.
5.1.   Two kinds of causal mechanism:
        Spatio-temporally continuous causal processes that transmit causal influence from one part of spacetime to another; Causal interaction – when two or more causal processes intersect in space-time they may or may not produce lasting modifications in one another.
5.2.   Two aspects of causal explanation:
        Aetiological, and Constitutive.
5.3.   Causal connections exist in the physical world and can be discovered by empirical investigation.

6. Van Fraassen.
6.1. Theories can save the phenomena and be empirically adequate without fitting the real world (even assuming we know what that is)
6.2. Explanation is *pragmatic*
6.3. Causal talk involves *framing the explanandum*.
6.4. Causation is not 'in the world' but in language – not language qua logic, but language qua *discourse* - a social matter.

Key Terms

Entailment

In contemporary logic texts often represented by: ⊨

A logical relationship between statements or propositions. An argument entails its conclusion when the conclusion follows deductively/necessarily/logically from the premisses. Sometimes expressed as 'therefore'.   The (syllogistic) argument:

> P1: All X are Y ∧   [for ∧ say 'and']
> P2: All Y are W ∧
> P3: No Y are Z
> ⊨ C: All X are W and No X is Z

is one in which the conclusion is entailed by the premisses

Implication

In contemporary logic texts often represented by: ⊢

A logical relationship between statements or propositions. An argument implies its conclusion when the conclusion can be said to 'follow' by inductive inference from the premisses.

> P1: All the swans so far observed are/have been white ∧
> P2: It is 1603 and the Queen is dead
> ⊢ C: The next swan we see will be white
>
>
> P: Marriages like Cindy's very rarely last
> ⊢ C: We shouldn't be surprised if Cindy's marriage does not last

Necessity

There is a form of necessity that governs relations between statements (a logical operator); usually represented by ☐ (called 'box'):

> ☐X (say 'necessarily X') is true in any world upon interpretation i iff [say 'if and only if'] for every possible world in the set of all possible worlds, X is true in every possible world upon interpretation i.

Possibility

A logical relationship between statements or propositions, usually represented by ◊ (called 'diamond')

	◊X	(say 'possibly X')
Note that this is equivalent to:	¬ ☐ ¬ X	(for ¬ say 'not')

Association

<u>David Hume</u> (1711-1776) was a key figure in 'associationism' – an eighteenth century analysis also associated with the work of <u>John Locke </u> (1632-1704) and <u>James Mill </u>(1773-1836). The starting point is the striking way our ideas (mental images etc) are associated with but independent of sense experiences, and the way our ideas seem to be systematically associated with each other. *Associative laws* for long dominated the philosophical analysis of psychology, and also generated the beginnings of experimental psychology. It became, in Imre Lakatos's words, though, a 'degenerating research programme'.

<u>From our point of view</u> the significance of association is that the relationship between the two entities associated is *nothing more than co-occurrence or correlation* – the concept of association carries no connotation or denotation of there being any mechanical connection, causal connection, or universal association, between the two entities.

Cause
<u>Hume</u> analyses our idea of cause as having three distinct elements:
- succession,
- contiguity, and
- necessary connection.

C causes (<u>C→</u>) E iff
- E follows C $\land$
- E and C are contiguous or connected by a chain of contiguous events, $\land$
- there is some necessity in the relationship between the two.

Hume offers two analyses of cause, implying that they are alternative formulations of the same relation.

'we may define a cause to be an object, followed by another, and where all the objects similar to the first are followed by objects similar to the second. Or in other words where, if the first object had not been, the second never had existed.' (<u>Enquiry Concerning Human Understanding</u> p76)

Note that the two propositions are <u>not</u> equivalent.
1.   E follows C; $\land$ $\forall$E a C follows.   [For $\forall$ read 'for all]
2. $\neg$E $\models$ $\neg$C

Hume's argument
The issue for Hume is *whether our idea of cause has any rational justification*. His argument is that
- we MAY observe constant conjunction (WHENEVER the barrier lifts the ball WILL roll down the incline, without exception); and
- we may observe the temporal ordering of barrier lifting prior to ball rolling (and NEVER observe the temporal ordering of ball rolling and then the barrier lifting); but
- we don't OBSERVE any necessity between barrier lifting and ball rolling – all we see is one thing after another.
- Further, there is no logical contradiction in:

$$[C] \land [\neg E]$$

 – not just because, say, something else prevents the ball from rolling even when the barrier has been lifted; but because there is no logical contradiction in the 'laws of gravity' reversing themselves.

Hume's argument then
- denies the *rationality* of our belief in any necessary connection between those events in the world we consider to be causally connected.
- but, that our belief is not rationally based is not a denial that we do have such a belief – its foundation is *psychological* (as is the foundation of our use of inductive inference, belief in the continuity of past into future etc.)

Hume anticipates a good deal of Mill's analysis of *methods for establishing that relations between objects, events or phenomena are causal*. In the <u>Treatise</u> Hume offers 'Rules by which to judge of cause and effect' which anticipate Mill's methods of agreement, difference, and concomitant variation. But these 'rules' pertain to our minds – they address the question 'when do we believe that two events are causally connected?'

	Hence the later shift to logic in philosophy of science.. (Psychology is not an adequate foundation for scientific knowledge)

Counterfactuals

- the causes of a simple event like the matchhead igniting seem on the face of it to be *infinite in number*. As well as
- *positive conditions*: the matchhead was struck against a rough surface, ...

we have a number of

- *background conditions*: Oxygen present, atmosphere dry, ...

and an infinite number of

- *counterfactual conditions*: there was no gale blowing, no human being present blowing against the spark, no fireman directing a firehose at the spark, ...

Realism
In the context of the philosophy of science 'realism' signals a number of analyses and approaches:
- The objects (proper objects) of science are real in the sense of existing quite independently of our models of them, knowledge of them, our concepts of them, or our measurements of them. These objects include entities, processes and relationships
- Statements about the proper objects of science have truth value – ie they are either true, or they are false
- What makes them true or false is something external – that is not our sense data, actual or potential, or the structure of our minds, or the structure or elements of our language etc.

<u>Who has said what about this?</u>

Hume
See above.

J.S.Mill
Constructed logical rules for determining when, in science, we may justifiably conclude that two events are causally connected: [<u>System of Logic;</u> Book III, Chs 1-8]

<u>Method of Agreement</u> *If two or more instances of the phenomenon under investigation have only one circumstance in common, the circumstance in which alone all the instances agree is the cause (or effect) of the given phenomenon.*

<u>Method of Difference</u> *If an instance in which the phenomenon under investigation occurs, and an instance in which it does not occur, have every circumstance in common save one, that one occurring in the former, the circumstance in which alone the two instances differ is the effect, or the cause, or an indispensable part of the cause, of the phenomenon.*

<u>Method of Concomitant Variation</u>   *The magnitude of a phenomenon P is a function of factors A, B, C....   The set of factors on the right hand side of this equation is the <u>full cause</u> of P, while each of the relevant factors is a <u>partial cause.</u>*

John Mackie (1917-1981)

1.   **Introduces the idea of a field:**
- This meets the problem that the causes of a simple event like the matchhead igniting seem on the face of it to be *infinite in number*.
- In Mackie's analysis the background conditions and the counterfactual conditions, are set aside as *part of the field*. This also solves familiar problems such as:
    'Since it is normal for people to be striking matches and lighting cigarettes in a residential flat, but a gas leak is abnormal and should not occur, we may well say that the explosion which wrecked this block of flats was caused by the presence of a quantity of gas rather than that it was caused by Jones lighting his cigarette'.
- nb: what if EVERYONE smoked? What would we then say was the cause of lung cancer (given that not all smokers contract lung cancer)?

2.   **INUS Cause**
- Frequently it is not only the case that (Mackie pp 61-2)
    - o   'All ABC are followed by P';   but also
    - o   'All DGH are followed by P';
- It could be that
    - o   'All ABC and/or All DGH and/or All JKL are followed by P';
    - o   'All P are preceded by ABC or DGH or JKL or ABCDGH or ABCJKL or
          DGHJKL or ABCDGHJKL'
- *'X is a necessary condition for Y'* means when an event of type Y occurs an event of type X
    also occurs;
- *'X is a sufficient condition for Y'* means when an event of type X occurs an event of type Y
    also occurs;
- Then [ABC or DGH or JKL] - is a condition which is *both necessary and sufficient for P*; and
- [ABC] is a condition which is *sufficient but not necessary for P*
    [DGH] is a condition which is sufficient but not necessary for P
    [JKL] is a condition which is sufficient but not necessary for P;
    [ABCDGH] is a condition which is sufficient but not necessary for P
    [ABCJKL] is a condition which is sufficient but not necessary for P
    [DGHJKL] is a condition which is sufficient but not necessary for P
    [ABCDGHJKL] is a condition which is sufficient but not necessary for P
- Each single factor (A, B, C, D, G, H, J, K, L) is *neither necessary nor sufficient for P;*
- But each is clearly related to P in a significant way:
- A (...L) is an *Insufficient but Non-redundant part of an Unnecessary but Sufficient condition for
    P*

<u>example</u>
- 'drinking wine causes intoxication'.
- the cluster of factors crudely indicated by the phrase 'drinking wine' contains somewhere
    within it an INUS condition of intoxication.
- 'ingesting alcohol' is an inus condition of intoxication:
    1. **Insufficient**:   need to ingest a certain amount (varies depending on body
       characteristics, mental characteristics, metabolism etc)
    2. **Non-redundant:**   alcohol is a significant element of intoxication (and wine
       drinking)
    3. **Unnecessary**:   could eat fermenting fruits, inhale solvents, etc.
    4. **Sufficient**:   ingesting alcohol DOES cause intoxication

Wesley Salmon (b.1925)

Two kinds of *causal mechanism*:
1) spatiotemporally continuous causal processes that transmit causal influence from one part
of spacetime to another.   (Note the term 'process').
2) causal interaction: when two or more causal processes intersect in spacetime they may or
may not produce lasting modifications in one another

These in turn enable us to sort out two aspects of *causal explanation*:
1) **aetiological explanation**: tells the story of how one event caused another and so on – a
caribou died 30,000 years ago, its carcass was preserved in ice for many millenia, later (5,000
years ago) a bone was found by a human artisan, s/he carved it into a useful and decorative
object.
2) **constitutive explanation:** the pressure exerted by a gas on the walls of a container is
explained in terms of momentum changes between the molecules and the walls (this is like
temperature and ice, bricks and glass, branches and cradles, sugar and syrup).

3) Salmon also wants to solve a problem from probability that we have met before.

- Hempel argues that we have an explanation when we have a set of conditions and probabilistic 'laws' such that the combination of conditions and laws means that there is a high probability that the explanandum would occur.
- However, supposing it were the case that overall it turns out that 20% of HIV positive people contract AIDS. Are we less likely to say that HIV causes AIDS than in the alternative case that 80% of HIV positive people contract AIDS? In either case HIV looks like an INUS cause of AIDS.
- And Salmon would want to say that we know HOW HIV causes AIDS (attacking the immune system, causing elements of the immune system to misrecognise cells, ...) so there is more to the relationship between HIV and AIDS than constant conjunction or regularity, as well as more to it than prediction.

'On the view of causality I am advocating, causal connections exist in the physical world and can be discovered by empirical investigation'. (p23).

Salmon's philsophy of causality
> *'involves relinquishing rational expectability as a hallmark of successful scientific explanation. Instead of asking whether we have found reasons to have expected the event to be explained if the explanatory information had been available in advance, we focus on the question of physical mechanisms. Scientific understanding, according to this conception, involves laying bare the mechanisms – aetiological or constitutive, causal or noncausal – that bring about the fact to be explained. If there is a stochastic process that produces one outcome with a high probability and another with low probability, then we have an explanation of either outcome when we cite the stochastic process and the fact that it gives rise to the outcome at hand in a certain percentage of cases. The same circumstance – the fact that this particular stochastic process was operating – explains the one outcome on one occasion and an alternative on another occasion.'. (p328)*

Bas van Fraassen (b.1941)
- *Realists criticise Hempel* because
  - the truth of premises is neither here nor there in his logical model of explanation.
  - there need not (in the model) be any relevance of the explanans to the explanandum, yet a genuine explanation seems to involve mechanisms and causes.
- *Van Fraassen criticises realists* because he thinks that truth is neither here nor there in scientific theories and explanations generally.
- To say that a theory explains some fact or other, is to assert a relationship between this theory and that fact, which is independent of the question whether the real world, as a whole, fits that theory.
- The word 'explain' can have its basic role in expressions of the form 'fact E explains fact F relative to theory T'.
- an explanation is an answer to a why question.

Why did Adam eat the apple? Why questions implicitly invoke:
- the topic (Adam eating the apple)
- background theory [what's the appropriate theory here? old testament Judaeo Xian theology?, New Testament Xian theology? science of human action? contemporary philosophy of the human condition?]
- a contrast class as in
  - why did Adam eat the apple (as opposed to Eve eating the apple)
  - why did Adam eat the apple (as opposed to using it for target practice)
  - why did Adam eat the apple (as opposed to the plums)
- relevance relation: closely connected with theoretical context; 'because Yahweh is a just God' is (perhaps) not relevant to the question why Adam ate the apple.

- van Fraassen argues *against realism.*
- He argues that theories can 'save the phenomena' and can be '*empirically adequate*' without fitting the real world as a whole, even assuming we can know what that consists in.
- *Explanation is* <u>pragmatic</u> – related to the concerns of users of theory and NOT related to the relationship between theory and 'facts' or theory and world.

Against philosophers like Mackie and Salmon van F argues, following Hanson:

> *There are as many causes of x as there are explanations of x. Consider how the cause of death might hav ebeen set out by a physician as 'multiple haemorrhage', by the barrister as 'negligence on the part of the driver', by a carriage builder as a 'defect in the brakeblock construction', by a civic planner as 'the presence of tall shrubbery at the turning'.* N R Hanson <u>Patterns of Discovery</u> 1958 p54

- vF observes that these are competing explanations, competing causes: what one analysis varies the other keeps fixed and we can't do all these at once. The selection of the salient causal factor is not simply a matter of pointing out the one that is of most interest to the relevant interlocutor; rather it is a matter of competing counterfactuals. (SI, p126)

- When we talk in causal language we frame the explanandum in various ways. What do we keep fixed and what do we vary? what surprises us? what is the contrast class for our explanation?

<div align="center">References</div>

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Logical Symbols used in these lectures

⊨   entailment (a relation between premisses and conclusions of an argument)

⊢   implication (relation between premisses and conclusions of an argument)

→   material implication; for P → Q read 'if P then Q'

∀   universal quantifier (for ∀X read 'for all X')

∃   existential quantifier (for ∃X read 'exists (an) X)

∧   and, but, also, as well as ......

∨   or   [∃X ∨ ∃Y] means 'there is either an X or a Y]

C→   causes, is the cause of, is a cause of

□   necessarily

◊   possibly

¬   not, negation

1.   Discuss the concepts and propositions entailed by Salmon's account of causation, as set out in the extract quoted.

2.   Do you agree with the following:

2.1.   Hume offers a subjectivist account of causation

2.2.   Salmon offers a realist account of causation

2.3.   van Fraassen offers a pragmatist account of causation

3.   Why is Mackie's account of the field, which in explanation 'set aside', so significant for the philosophical analysis of explanation?