Week 8

Explanation

van Fraassen, Friedman

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Outline

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Homework

What are Cartwright's reasons for arguing that explanations require no covering laws? And what *is* then required in explanations, according to her view?

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1 Pragmatics of explanation

Hempel's false ideals

- One false ideal: in Hempel's hands explanation has become a relation between a theory (laws) and the phenomenon.
- But we may just as well say that a phenomenon is explained when *we* explain with the help of a theory.
- The second false ideal: explanatory power of the theory is identical to its acceptability.
- But there are false theories that explain.
- Generally, explanatory power should only be part of the reason for accepting the theory.
- The third false ideal: the explaining power of a theory is its primary virtue.
- Well, not always: we may also accept the theory, for other reasons, before using it for explanation.

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Why-questions: first attempt

- We can interpret the D-N and P-S models as saying that conditions (or 'factors') explain the explanandum relative to a theory T (that contains the 'laws').
- So the condition C explains E relative to T just in case: T entails a certain proposition $\phi(C, E)$ expressible in the calculus of logic or probability theory.
- Bengt Hannson made an important amendment by introducing a contextual factor of the contrastive class into $\phi(C, E, X)$.

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Hannson's contrastive class

- According to Hannson's proposal, explanations are answers to some aspects, perhaps contextually interpreted, of why-questions.
- To answer a question 'Why p?', I must first fix a contrastive class X of propositions, and then interpret the original question as 'Why p, rather than x?', where $x \in X$.

Example 1. If my question is, 'Why did *the mayor* get paresis?', I am in effect asking, 'Why did the mayor, and not anyone else in town, get paresis?' Propositions of the contrastive class contain reference to the townsfolk. The original question may be answered by citing his syphilis. If, however, I am asking 'Why did the mayor, and not anyone else in the syphilis ward, get paresis?', the question has no answer (within the medical theory).

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2 Why-questions (cont.)

Hannson's formula

- According to Hannson, q is the correct answer to our original question only if:

$$P(p \mid q) > \frac{P(x_1 \mid q) + P(x_2 \mid q) + \cdots + P(x_n \mid q)}{n},$$

  where $X = \{x_1, x_2, ..., x_n\}$.
- But this solution, van Fraassen argues, fails to solve the asymmetry problem, such as the case of the barometer and the storm.

Question
Why is Hannson's solution inept in solving the asymmetry problem?

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3 Van Fraassen's diagnosis

Asymmetry: First solution

- We must be able to distinguish propositions that are correlated perfectly in alternative circumstances, but whose explanatory roles are very different.
- One solution is to distinguish facts from sentences. Sentences having matching truth values across possible worlds can be made true by different facts.
- Thus while the state of the barometer and the storm are perfectly correlated, each is made true by different facts.
- This is a nice solution, but the talk of facts is spurious.

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Asymmetry: Second solution (back to Aristotle)

- Another solution is Aristotelian: Aristotle makes a distinction between 'demonstrations' and 'explanations'.
- A demonstration can be any valid argument. An explanation is an argument whose premisses necessarily contain a *cause* of the fact stated in the conclusion.
- But we have to enlarge the notion of a cause to make this proposal adequate.
- For consider: the atomic structure of an element may explain the chemical behaviour of that element, yet it would not be a 'cause', in our modern view, of that behaviour.
- Aristotle, however, provides a theory of causes that allows to regard even the atomic structure as a cause.
- A lantern, for instance, has wood as its material cause. Or: lantern has wood as its 'essence'.
- So: the premisses of an adequate explanation must state the essence of the phenomenon we are to explain.

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Objection to the Aristotelian solution

What property is essential cannot be context-dependent. But what property is explanatory *is* context-dependent. Essence and explanation, therefore, come apart.

Example 2. Reconsider the flagpole case. We normally come with a fixed function $f(x,t)$ yielding the length of the shadow, where we plug in the length x of the pole and the time t of the day. The length x seems to be the essential cause of the shadow. But on some occasions it is the length of the pole that can be explained by the length of the shadow (where, that is, we tweak the pole's length to get the shadow exactly that long). There the function $g(y,t,z)$ will yield the length of the pole depending on the length y of the shadow, the time t, and some other factor z (a giant sundial in van Fraassen's example). Here the essence gets to be explained by an accident.

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Flagpoles and dalliances

During my travels along the Saône and Rhône last year, I spent a day and night at the ancestral home of the Chevalier de St. X..., an old friend of my father's. The Chevalier had in fact been the French liaison officer attached to my father's brigade in the first war, which had—if their reminiscences are to be trusted—played a not insignificant part in the battles of the Somme and Marne.

The old gentleman always had *the à l'Anglaise* on the terrace at five o'clock in the evening, he told me. It was at this meal that a strange incident occurred; though its ramifications were of course not yet perceptible when I heard the Chevalier give his simple explanation of the length of the shadow which encroached upon us there on the terrace. I had just eaten my fifth piece of bread and butter and had begun my third cup of tea when I was roused by the Chevalier's voice. 'The shadow of the tower will soon reach us, and the terrace will turn chilly. I suggest we finish our tea and go inside.' I looked around, and the shadow of the rather curious tower I had earlier noticed in the grounds, had indeed approached to within a yard from my chair. The news rather displeased me, for it was a fine evening; I wished to remonstrate but did not well know how, without overstepping the bounds of hospitality. I exclaimed: 'Why must that tower have such a long shadow? This terrace is so pleasant!'

His eyes turned to rest on me. My question had been rhetorical, but he did not take it so. 'As you may already know, one of my ancestors mounted the scaffold with Louis XVI and Marie Antoinette. I had that tower erected in 1930 to mark the exact spot where it is said that he greeted the Queen when she first visited this house, and presented her with a peacock made of soap, then a rare substance. Since the Queen would have been one hundred and seventy-five years old in 1930, had she lived, I had the tower made exactly that many feet high.'

It took me a moment to see the relevance of all this. Never quick at sums, I was at first merely puzzled as to why the measurement should have been in feet; but of course I already knew him for an Anglophile. He added drily, 'The sun not being alterable in its course, light travelling in straight lines, and the laws of trigonometry being immutable, you will perceive that the length of the shadow is determined by the height of the tower.' We rose and went inside.

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Flagpoles and dalliances II

I was still reading at eleven that evening when there was a knock at my door. Opening it I found the housemaid, dressed in a somewhat old-fashioned black dress and white cap, whom I had perceived hovering in the background on several occasions that day. Courtseying prettily, she asked, 'Would the gentleman like to have his bed turned down for the night?'

I stepped aside, not wishing to refuse, but remarked that it was very late—was she kept on duty to such hours? No, indeed, she answered, as she deftly turned my bed covers, but it had occurred to her that some duties might be pleasures as well. In such and similar philosophical reflections we spent a few pleasant hours together, until eventually I mentioned casually how silly it seemed to me that the tower's shadow ruined the terrace for a prolonged, leisurely tea. At this, her brow clouded. She sat up sharply. 'What exactly did he tell you about this?' I replied lightly, repeating the story about Marie Antoinette, which now sounded a bit far-fetched even to my credulous ears.

'The servants have a different account', she said with a sneer that was not at all becoming, it seemed to me, on such a young and pretty face.

'The truth is quite different, and has nothing to do with ancestors. That tower marks the spot where he killed the maid with whom he had been in love to the point of madness. And the height of the tower? He vowed that shadow would cover the terrace where he first proclaimed his love, with every setting sun—that is why the tower had to be so high.'

I took this in but slowly. It is never easy to assimilate unexpected truths about people we think we know—and I have had occasion to notice this again and again.

'Why did he kill her?' I asked finally. 'Because, sir, she dallied with an English brigadier, an overnight guest in this house.' With these words she arose, collected her bodice and cap, and faded through the wall beside the doorway.

I left early the next morning, making my excuses as well as I could. 12

4 Van Fraassen's solution

The pragmatical solution

- The new approach utilises the context of the utterance of a particular question: that context identifies the intentions of the utterers (see the reference to Stalnaker in page 64).
- Every token-question (i.e. a particular dated utterance) is assigned a presupposition.
- So 'Why p?' must be interpreted as 'Why p, in contrast to X?', where the original question is supplemented with a contrastive class X.
- The token-question, on a given occasion, presupposes that $p \in X$, and that p is true, while most members of X are false.
- The problem of asymmetry will be solved by sorting answers into relevant and irrelevant, depending on the presupposition of the question token.

Question
Give an example illustrating van Fraassen's solution. 13

5 Problems with van Fraassen

Trivialisation of the pragmatic approach

- Van Fraassen's solution interprets a why-question as a triple $\langle P_k, X, R\rangle$, where R is a relevance relation.
- The point of R is to differentiate between appropriate and inappropriate answers to the why-question.
- In the situation where the propositions A and A' are true in the same possible worlds, the answer 'Because A' is logically equivalent to the answer 'Because A''.
- However, only one of them may be an appropriate explanation of the phenomenon. The relation R is supposed to distinguish between these two logically equivalent, but explanatorily non-equivalent, answers. 14

Trivialisation: specifics

Example 3. The question 'Why was there infrastructure damage in Bodrum over the weekend?' is answered by saying, 'Because there was a storm.' The answer-proposition is equivalent to 'Because every barometer in Bodrum, if it were installed there, would have fallen.' However, the latter is ruled out as an explanation by being irrelevant.

- But the lack of restrictions on the relevance relation makes it possible for any true proposition A to explain any other true proposition P_k.
- Let the question be 'Why P_k?' Let $X = \{P_k, \sim P_k\}$.
- We stipulate that A is a relevant answer to P_k, given the contrastive class X: $R = \{\langle A, \langle P_k, X\rangle\rangle\}$.
- That is, there is a why-question $\langle P_k, X, R\rangle$, and A is the only answer to it. 15

Loose relevance leads to trivialisation

Example 4. Suppose that the question is 'Why is the roof in my apartment **leaking**?' The topic P_k is the proposition 'The roof in my apartment is leaking.' Let $X = \{$'The roof in my apartment is leaking', 'The roof in my apartment is not leaking'$\}$. Let K be a body of knowledge containing a yoga theory. And let the relevance relation R be a relation of emotional influence, so that R contains pairs of my emotional attitudes to the apartment and various disturbances in it. Then the answer A may contain a true statement of my negative attitude to the apartment and the leakage in it. 16

Other problems

- It is not clear that every explanation should be an answer to a why-question.
- Some explanations may be answers to how-actually-questions.
- Also, has the problem of asymmetry been solved at all?
- It could have been, if we could rule out trivial explanations.

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6 Explanation as unification

Purposes of scientific explanation

- Friedman begins by observing that the object of scientific explanation is usually regularities, rather than events.
- Also, a typical scientific explanation proceeds by relating the behaviour of problematic phenomena A to the behaviour of less problematic phenomena B.
- Friedman says that this is 'reduction'.
- But what kind of reduction is involved, e.g., in the explanation of steam?
- "The behaviour of water is reduced to the behaviour of molecules."

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Understanding

- Explanation generates understanding.
- But we cannot in advance say how it is done.
- Available accounts of explanation yield unintuitive consequences about understanding.
- We can learn from their mistakes.

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Prediction

- Just because we expect a certain phenomenon need not entail that we understand why it happens.
- Observing the barometer's behaviour I may expect a storm to begin, but of course I do not understand why it will happen.
- Here notice that the D-N model touted as an account of explanation is also naturally viewed as an account of prediction.
- But is it reasonable to think that whenever we can predict we can also explain, and vice versa?

Question
Try to give an example in which one can explain X but cannot predict it.

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Familiarity

- So what is the explanation relation?
- Dray's proposal: to explain is to relate the explanandum to the already familiar explanans.
- This is a non-starter.
- We explain the light phenomena (very familiar) by relating them to the very unfamiliar concepts (electromagnetic waves).

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Reduction to the already understood

- Another proposal: to explain is to relate the explanandum to the already understood explanans.
- Not good: we are often happy to explain by relating phenomena to the explanans not themselves understood.
- For example, the orbits of the planets were said to be explained by the gravitational pull of the Sun, but gravitation itself is not (certainly was not at the time) well understood.

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Unification

- Requirements for a successful explanation: generality, objectivity, and improvement of understanding.
- Previous proposals fail at least one of these requirements.
- New proposal: explanation works by unification.
- In every given epistemic situation there are certain *brute facts*.
- Each of them seemingly have no connection with each other: we say that they are *independently acceptable* (i.e. acceptable independently of each other).
- A successful explanation transforms the situation K_1 into another situation K_2 where there are fewer brute facts.
- Observe that explanation so interpreted is concerned with explaining laws (empirical generalities), rather than individual events. (Why?)

Question
Should Kuhn's account of scientific revolutions stand in contradiction with Friedman's requirements of objectivity?

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7 Details of the unification proposal

Unification in action

Newtonian mechanics
Why should we treat Newtonian mechanics as explanatory at all? It leaves many of its central concepts unexplained. Do we understand what force really *is*? Or momentum? Or do we understand gravitation? However, it allows us to connect previously unconnected phenomena. From the laws of mechanics we can derive the laws describing the behaviour of celestial bodies (Kepler's laws) and the laws describing the falling bodies in the vicinity of our planet (Galileo's laws). So: at the end of the day, science has mysteries, but it works by lowering the number of these mysteries.

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Details of Friedman's proposal

- We need a method for identifying brute facts in a given epistemic situation.
- This is done by isolating K-atomic sentences.
- Roughly put, these sentences cannot be logically decomposed into independently acceptable sentences.
- So to explain is to reduce the number of K-atomic sentences.

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