Scientific Explanation II

Preliminary Remarks

- Last week: D-N Model

- One of the demands we placed on explanations is that they are deductively valid arguments.

- This week: I-S Model and other accounts of explanation.

Inductive-Statistical Model

- The Covering Law Model encompasses two complementary models of explanation: (1) Deductive-Nomological and (2) Inductive-Statistical
- I-S: The explanandum is not deductively inferred but rather *inductively.* We thus speak of *inductive strength* or *high probability* instead of entailment.
- More precisely, 4 conditions must be satisfied:

  1) True premises.
  2) Empirical content.
  3) Explanans must confer high probability on the explanandum.
  4) At least one probabilistic law in the premises.

Inductive-Statistical Model (2)

- Logical Form of I-S explanations:

$C_1, C_2, \ldots, C_n$ explanans

$L_1, L_2, \ldots, L_m$ [x%]

$\therefore O_1, O_2, \ldots, O_k$ explanandum

where *x* is very high

Inductive-Statistical Model (3)

Example:

Question: Why does child *A* have measles?

Answer:

1. Child *A* has been in contact with Child *B* who has measles.
2. 99% of children who come into contact with those infected by measles also contract measles. [99%]

∴ Child *A* has measles.

I-S Model Problem

- It cannot explain events that are highly unlikely, yet do happen. In other words, high probability requirement faulty.

  EXAMPLE

  Question: We want to explain why Patient A has paresis.

  Problem: Very low percentage of those who have untreated syphilis contract paresis. Yet we can explain that they have paresis by citing untreated syphilis**.** Indeed, only those who have syphilis contract paresis.

  Main Point: We have a good explanation that does not meet the high probability requirement.

Problems for both D-N and I-S

- Historical explanations rarely, if ever, appeal to laws, whether deterministic or probabilistic.

- More generally, can explanations like that be given in social science and everyday life where laws are rare, inexistent, or unnecessary?

- Even when we deal with physics or chemistry, we still face the general problem of discriminating between laws of nature and accidental generalisations.

Statistical Relevance Model (1)

- Wesley Salmon's brainchild
- Scientific Explanations are neither deductive nor inductive arguments.
- Instead, an explanation is information that is statistically relevant to an explanandum.
- More precisely: Something is *statistically relevant* iff it changes the probability of an event happening.
- NB: It is not required that there is an *increase* in probability but that there is a *change*.

Statistical Relevance Model (2)

- More formally, *C* is *statistically relevant* to *B* if and only if P(B/A.C) ≠ P (B/A).
- Example: Birth Control Pills (BCP for short)

  P(Pregnancy/Male.BCP) = P(Pregnancy/Male)

  i.e. BCP statistically *irrelevant*.

  P(Pregnancy/Female.BCP) ≠ P(Pregnancy/Female)

  i.e. BCP statistically relevant.

  Indeed, BCP can be employed in the explanation of pregnancy rates in women.

Statistical Relevance Model (3)

- No high probability requirement. It can thus explain events that are unlikely, something the I-S model was incapable of doing.
- Take the syphilis/paresis example:

P (Paresis/UntreatedSyphilis) ≠
P (Paresis/Treated or No Syphilis)

Main Point: Even though a very low percentage of those with untreated syphilis contract paresis, we can still cite untreated syphilis to explain paresis because untreated syphilis is *statistically relevant*.

Statistical Relevance Model – Problems

- Cartwright's objection against sufficiency:

  Suppose: I spray poison ivy with defoliant which is 90% effective.

  Question: Why is this poison ivy alive?

  SRM answers: Because it was sprayed with the defoliant.

  Note: P (Alive/NotSprayed) ≠ P (Alive/Sprayed)

Other Accounts of Explanation

- Unificationist Accounts

  Main idea: A scientific explanation provides a unified account of varied phenomena.

  Prominent Advocates: Friedman and Kitcher.

- Causal Accounts

  Main idea: A scientific explanation provides a causal account.

  Prominent Advocates: Salmon.

- Pragmatic Accounts

  Main idea: A scientific explanation plays a pragmatic role in theory acceptance but nothing more.

  Prominent Advocates: Van Fraassen.

Food for Thought

- What are the desiderata for explanation? Unification? Understanding? Causal Factors? Statistical Factors? Laws? None of these? Some of these? All of these?

Reading

- Hemple, C.G. (1962) ‘Two Basic Types of Scientific Explanation’ in Curd and Cover, pp. 685-694.
- Hemple, C.G. (1965) ‘ The Thesis of Structural Identity’, in Curd and Cover, pp. 695-705.