Woodward 5
The DN and IS Models of Explanation

(pp. 152–161)

Patrick Maher
Philosophy 471

Fall 2006

Scientific explanation

To explain the phenomena in the world of our experience, to answer the question "why?" rather than only the question "what?" is one of the foremost objectives of empirical science.
(Hempel and Oppenheim 1948)

Examples

There are scientific explanations for:

- Why the sky is blue.
- Why the dinosaurs became extinct.
- Why the planets orbit the sun.
- Why South Africa and Australia have similar flora.

In what follows, "explanation" means scientific explanation (as opposed to, e.g., explaining how to bake a cake).

Carl Hempel advocated the following general conception of scientific explanation:

> *To explain a phenomenon is to show that, in view of the circumstances and the laws of nature, the phenomenon was to be expected.*

Formulation due to Wesley Salmon:

> *The essence of scientific explanation can be described as <u>nomic expectability</u>—that is, expectability on the basis of lawful connections.*

The following models articulate this conception.

The DN model

Definition (my terminology)

A deductive-nomological (DN) argument is a valid argument in which the premises are true and contain at least one law of nature essentially.

Example

A flagpole on flat ground is 25 feet high.
The sun is 30 degrees above the horizon.
Light travels in straight lines.
_____
The flagpole's shadow is 43 feet 4 inches long.

If explanation consists in showing nomic expectability then:

H1 (my terminology)

Every DN argument explains the facts mentioned in its conclusion.

Counterexamples to H1 (Bromberger 1966, Salmon 1971)

- A flagpole on flat ground has a shadow 43 feet 4 inches long.
  The sun is 30 degrees above the horizon.
  Light travels in straight lines.

  The flagpole is 25 feet high.

- *Similarly, one can derive the length of a simple pendulum
  from information about its period T, the acceleration g due
  to gravity that it experiences, and the law $T = 2\pi\sqrt{l/g}$, but
  such a derivation is again no explanation.*

- No males who take birth control pills get pregnant.
  John Jones is a male who has been taking birth control pills.

  John Jones hasn't got pregnant.

The IS model

> **Definition** (my terminology)
>
> An inductive-statistical (IS) argument is an argument in which the conclusion is probable but not certain given the premises, and the premises are true and contain at least one statistical law of nature essentially.

> **Example** (Hempel 1965)
>
> The probability of recovery from strep is high when given penicillin. Jones had strep and was given penicillin.
>
> Jones recovered from strep.

If explanation consists in showing nomic expectability then:

> **H2** (my terminology)
>
> Every IS argument explains the facts mentioned in its conclusion.

Counterexample to H2 (Salmon; not in Woodward)

Most people with a cold who take large doses of vitamin C
recover within a week.

Linus had a cold and took large doses of vitamin C.

Linus recovered within a week.

*(Assume that the rate of recovery is the same for people who do
and don't take large doses of vitamin C.)*

A necessary condition

If explanation consists in showing nomic expectability then:

H3 (my terminology)

Every explanation is either a DN or an IS argument.

Counterexamples to H3 (Scriven 1959)

- General paresis (also called paralytic dementia) is caused by untreated syphilis, but only about 25% of people with untreated syphilis develop general paresis. If someone develops general paresis, this can be explained by observing that the person had untreated syphilis.

- *As you reach for the dictionary, your knee catches the edge of the table and thus turns over the ink-bottle, the contents of which proceed to run over the table's edge and ruin the carpet. If you are subsequently asked to explain how the carpet was damaged you have a complete explanation. You did it, by knocking over the ink.*

Hempel's response to Scriven's examples

- *Precisely because paresis is such a rare sequel of syphilis, prior syphilitic infection surely cannot by itself provide an adequate explanation for it. A condition that is nomically necessary for the occurrence of an event does not, in general, explain it; or else we would be able to explain a man's winning the first prize in the Irish sweepstakes by pointing out that he had previously bought a ticket.* (Hempel 1965, pp. 369–370)

- *Presumably the explanation [Scriven] has in mind would be expressed by a statement roughly to the effect that the carpet was stained with ink because the table was knocked. But, surely, this statement claims by implication that the antecedent circumstances were of a kind which generally yields effects of the sort to be explained. Indeed, it is just this implicit claim of covering uniform connections which distinguishes the causal attribution here made from a mere sequential narrative.* (Hempel 1965, pp. 360–361)

1. What is a DN argument? What is an IS argument?
2. Describe a counterexample to the claim that every DN argument is an explanation.
3. Describe an alleged counterexample to the claim that every IS argument is an explanation.
4. What did Scriven claim that his paresis example showed? How did Hempel argue that it doesn't show this?
5. What did Scriven claim that his ink bottle example showed? How did Hempel argue that it doesn't show this?