Lange 3
Laws, Explanation, and Induction

(pp. 16-23)

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Philosophy 471

Fall 2006

Laws and explanation (pp. 16–18)

A "scientific explanation" is a certain kind of answer to a why-question, such as, "Why did the dinosaurs go extinct?"

Hempel's claim

"A law can, whereas an accidental generalization cannot, serve as a basis for explanation."

Examples that fit Hempel's claim

- *We might explain why a certain powder burns with green flames, rather than with flames of any other color, by noting that the powder is a copper salt and that it is a law of nature that all copper salts, when ignited, burn with green flames.*
- *We cannot explain why my wife and I have two children by citing the fact that all of the families on our block have two children—since this last is an accident.*

Contrary to Hempel, accidental generalizations *can* serve as the basis for an explanation.

Examples

- *That all of the coins in my pocket are silver explains why it was that I ended up with a silver coin when I selected a coin at random.*
- *A given car's maximum speed on a dry, flat road could be explained by the distance of its gas pedal from the floor and the relation between this distance and the maximum speed. This relation is accidental (since it depends on how the car happens to be constructed.)*

Furthermore, even if it is a law that all F are G, an object's being F may not explain its being G.

Example

It is a law that all pendulums of period T have a length equal to $gT^2/4\pi^2$, and yet (at least typically) a pendulum's period does not help to explain its length.

Skeptical hypothesis

"A fact's lawhood makes no difference at all to its explanatory significance."

Counterexample to the skeptical hypothesis

Suppose that all ignited samples of copper salt burn with green flames not because this is physically necessary, but because as it happens, no sample of a certain rare copper salt, whose flames are not green, is ever ignited. Then the fact that the given powder is a copper salt does not explain why it burns with green flames when it is ignited.

View Lange defends in chapter 8

- What is needed for a fact to serve as a basis for explanation is an appropriate range of invariance.
- So if an accidental truth has an appropriate range of invariance, it can serve as a basis for explanation.
- The range of invariance that is appropriate for a scientific explanation depends on the why-question and its context.

Questions

1. Give one example of each of the following (four examples altogether).
   (a) Showing that a fact follows from a law:
      i. Explains the fact.
      ii. Does not explain the fact.
   (b) Showing that a fact follows from an accidental generalization:
      i. Explains the fact.
      ii. Does not explain the fact.
2. Does it ever make a difference to explanation whether a generalization is an accident? Justify your answer.

Laws and induction (pp. 18–23)

Definition

A generalization is inductively confirmed if evidence that it holds in some instances raises the probability that unobserved instances also conform to the generalization.

Scientists often inductively confirm hypotheses that they believe may be a law.

Example

Boyle supported his law $PV = k$ by showing that it held for particular values of P and V; this raised the probability that other, unexamined values of P and V also satisfied $PV = k$.

Generalizations that we think would be accidents if true are often not inductively confirmed by finding positive instances.

Examples

- *Every coin I receive in change today will be a penny.*
  That the coins I have received in change so far today have all been pennies does not increase the probability that the next coin I receive in change today will be a penny.
- *All presidents of the United States elected in a year ending with "0" between 1821 and 1979 died in office.*
  That William Henry Harrison (elected in 1840) died in office does not raise the probability that James Garfield (elected in 1880) died in office.

Hypothesis

Generalizations that we think would be accidents if true cannot be inductively confirmed.

Counterexamples to this hypothesis

- *Every person of entirely Native-American heritage has blood of type O or A.*
  Checking the blood types of a large representative sample of Native Americans was sufficient for anthropologists to conclude that this is true of all Native Americans. But it is believed to be a historical accident.
- *All the pears now on this tree are ripe.*
  Finding that some pears on the tree are ripe raises the probability that the other pears on the tree are also ripe. But if true, it is an accident.

View Lange defends in chapter 4

- The above definition of inductive confirmation is unsatisfactory. Inductive confirmation should be defined in terms of the *reason why* the evidence bears on unexamined cases.
- With a proper definition of inductive confirmation, the above hypothesis is correct: Generalizations that we think would be accidents if true cannot be inductively confirmed.

Question

3. Suppose that a generalization is inductively confirmed if evidence that it holds in some instances raises the probability that unobserved instances also conform to the generalization. Using this definition, give one example of each of the following (three examples altogether).
   (a) A generalization that was believed to possibly be a law and was inductively confirmed by positive instances.
   (b) A generalization that we believe would be an accident if true and that is:
      i. Inductively confirmed by positive instances.
      ii. Not inductively confirmed by positive instances.