Lecture 2
Popper's Deductive Method

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Scientific Thought II
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Karl Popper

1902: Born in Vienna.

1935: *Logic of Scientific Discovery* (in German).

1937–1945: Lecturer at Canterbury, New Zealand.

1946–1969: Professor at London School of Economics.

1959: English translation of *Logic of Scientific Discovery*.

1994: Died in London.

The problem of induction

Statement of the problem (27–28)

According to a widely accepted view—to be opposed in this book—the empirical sciences can be characterized by the fact that they use 'inductive methods', as they are called . . .

It is usual to call an inference 'inductive' if it passes from singular statements (sometimes also called 'particular' statements), such as accounts of the results of observations or experiments, to universal statements, such as hypotheses or theories.

Now it is far from obvious, from a logical point of view, that we are justified in inferring universal statements from singular ones, no matter how numerous; for any conclusion drawn in this way may always turn out to be false: no matter how many instances of white swans we may have observed, this does not justify the conclusion that all swans are white.

The question whether inductive inferences are justified, or under what conditions, is known as the problem of induction.

Terminology

- Analytic statement: A statement whose truth follows from the meanings of the words in it.

  Example: All bachelors are unmarried.

- Contradiction: A statement whose falsity follows from the meanings of the words in it.

  Example: Some bachelors are married.

- Synthetic statement: A statement that is neither analytic nor a contradiction; its truth or falsity depends on the facts, not just the meanings of the words in it.

  Example: Karl Popper was married.

Popper's argument (28–29)

- *If we want to find a way of justifying inductive inferences, we must first of all try to establish a principle of induction. A principle of induction would be a statement with the help of which we could put inductive inferences into a logically acceptable form.*
- *Now this principle of induction cannot be . . . an analytic statement. Indeed, if there were such a thing as a purely logical principle of induction . . . all inductive inferences would have to be regarded as purely logical or tautological transformations, just like inferences in deductive logic. Thus the principle of induction must be a synthetic statement.*
- *The principle of induction must be a universal statement in its turn. Thus if we try to regard its truth as known from experience, then the very same problems which occasioned its introduction will arise all over again. To justify it, we should have to employ inductive inferences; and to justify these we should have to assume an inductive principle of a higher order.*

Comparison of Popper and Hume on induction

Agreement:

- Inductive inferences aren't justified.

Differences:

- Their arguments
  - Hume said beliefs about the future assume the future will be like the past.
  - Popper says they assume a "principle of induction" but he doesn't say what this principle is.
- Acceptability of inductive inferences
  - Hume thought we do make inductive inferences and it is sensible and practically necessary to do so.
  - Popper thinks science and everyday life can proceed without using induction.

Popper's scientific method

How theories are tested (32–33)

1. A hypothesis is proposed. This is not justified and is tentative.
2. Testable predictions are deduced from the hypothesis and previously accepted statements.
3. We observe whether the predictions are true.
4. If the predictions are false, we conclude the theory is false.
5. If the predictions are true, that doesn't show the theory is true, or even probably true. All we can say is that the theory has so far passed the tests of it.

Example (by me)

1. Newton proposes the law of universal gravitation (G).
2. From G plus the laws of motion and other accepted statements, we deduce what the motion of the moon or planets should be.
3. We observe the motion of the moon or planets.
4. If the observed motion of the moon or planets differs from what was predicted using G, we conclude that G is false.
5. If the observed motion of the moon and planets agrees with the predictions, we can't infer that G is true, or even probably true. All we can say is G has so far passed the tests of it.

The method is purely deductive

- *Nothing resembling inductive logic appears in the procedure here outlined. I never assume that we can argue from the truth of singular statements to the truth of theories. I never assume that by force of 'verified' conclusions, theories can be established as 'true', or even as merely 'probable'.* (33)
- Falsification uses the deductively valid form *modus tollens*:

$$\begin{array}{l} \text{If } T \text{ then } E. \\ \text{Not } E. \\ \hline \text{Not } T. \end{array}$$

- *It is possible by means of purely deductive inferences (with the help of the modus tollens of classical logic) to argue from the truth of singular statements to the falsity of universal statements. Such an argument to the falsity of universal statements is the only strictly deductive kind of inference that proceeds, as it were, in the 'inductive direction'; that is, from singular to universal statements.* (41)

Comparison with method of hypothesis

Similarities:

- We start with a hypothesis, deduce testable predictions from it, and observe whether the predictions are true or not.
- If the predictions are false, we conclude the hypothesis is false.

Difference:

- On the method of hypothesis, verified predictions increase the probability that the hypothesis is true. According to Popper, verified predictions are no reason to believe the hypothesis is true or even probable.

Requirements for empirical science

The problem

- In Vienna after the first world war there was lively discussion of:
  - The psychoanalytic theories of Freud and Adler.
  - Einstein's general theory of relativity.
- Popper came to think that Freud's and Adler's theories were not really science but Einstein's theory was.
- But what is the difference between a scientific theory and an unscientific one? For Popper, it isn't that scientific theories are supported by the evidence; according to him, they aren't.

Popper's requirements (39)

An acceptable theory in empirical science must be:

- *Synthetic*, i.e., not true or false just by meaning.
- *Falsifiable*, i.e., there is some possible observation that would contradict the theory.
  - Popper said Freud's and Adler's theories of psychoanalysis are synthetic but not falsifiable.
  - Newton's and Einstein's theories of gravity are falsifiable.
- *Corroborated*, i.e., the theory has been tested and has passed all its tests so far.

Questions

1. Explain what it means for a statement to be analytic or synthetic and give an example of each kind of statement.
2. State one similarity and two differences between Popper and Hume on induction.
3. Compare and contrast Popper's view of scientific method with the method of hypothesis (as advocated, for example, by Descartes).
4. What are Popper's requirements for an acceptable theory in empirical science? Explain what each requirement means.

Reference


Karl Popper.
The Logic of Scientific Discovery.
Basic Books, 1959.
Online at Questia.
Numbers in parentheses are page numbers of this book.