

Scientific Inference

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Objectives

- **Induction**
- **Deduction**

Induction

- **Method of basing general statements on accumulated observations of specific instances**
- **Seen as the hallmark of science**

Induction

- **Process of inferring a general law or principle from the observation of particular instances**

Deduction

- Inference by reasoning from generals to particulars

Greenland 1998

Example

- All assistant professors at PLFSOM possess an earned doctorate.
- John is an assistant professor at PLFSOM.
- I deduce that John holds an earned doctorate.

Induction

- **Method of basing general statements on accumulated observations of specific instances**
- **Seen as the hallmark of science**
- **Hume: no number of singular observation statements could logically entail an unrestrictedly general statement**

Induction

“The whole of our science assumes the regularity of nature—assumes that the future will be like the past in all those respects in which natural laws are taken to operate—yet there is no way in which this assumption can be secured.”

– Bryan Magee (1985)

David Hume (1711 - 1776)

- **No way of demonstrating the validity of inductive procedures**

Hume's Problem

- **Concerns the logical basis of inferences from observed matters of fact to unobserved matters of fact**
- **Such inferences cannot be made with certainty: There can be no demonstrative (deductive) inference from the past and present to the future**

Popper's Great Achievement

- **Offered an acceptable solution to the problem of induction**
- **Verification vs. Falsification**
- **Scientific laws are testable even though they can't be proven: they can be tested by systematic attempts to refute them**

Who is Karl Raimund Popper?

- “I think Popper is incomparably the greatest philosopher of science that has ever been.”

— Sir Peter Medawar

Science, in Popper's view,
advances by disproof rather than
proof

Buck 1975

Sir Karl Popper, PhD, FRS (1902 – 1994)

- **Vienna**
- **Mother musician**
- **Father was attorney**

www.wikipedia.org

Miller 1985

Academic Career

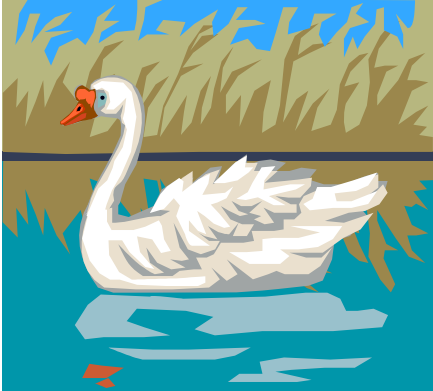
- **Professor in logic and scientific method,
London School of Economics**

Audi 1999



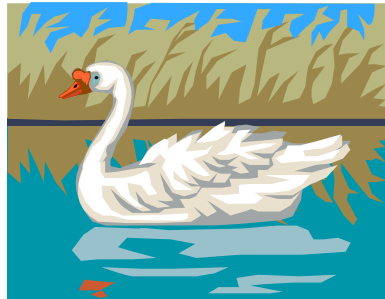
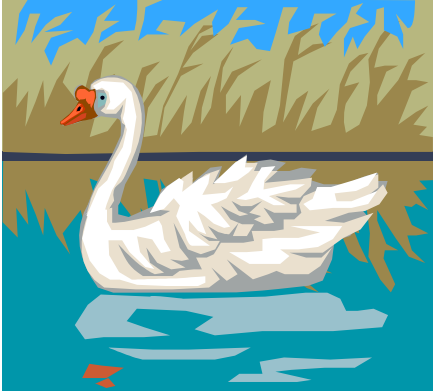
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Scenario 1



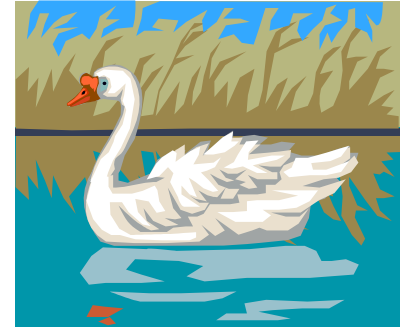
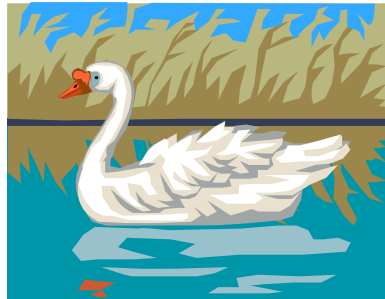
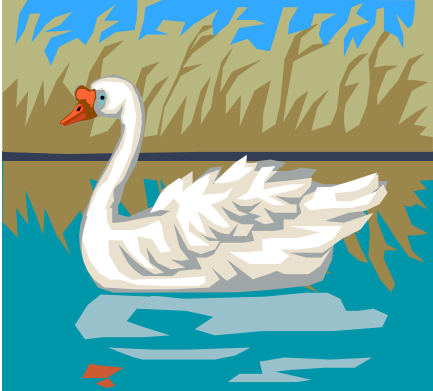
Magee 1985

Scenario 1



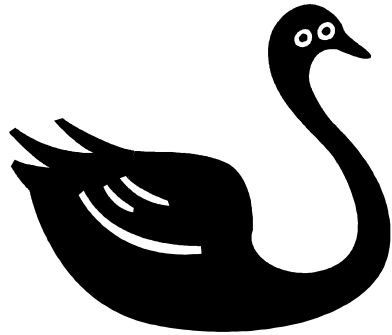
Magee 1985

Scenario 1



Magee 1985

Scenario 1



Magee 1985

Inductive Argument

- **Swan 1 is white.**
- **Swan 2 is white.**
- **Swan 3 is white.**
- **...**
- **Swan 1000 is white.**
- **Therefore, all swans are white.**

Deductive Argument

- **I observe that the following is true: there exists a non-white swan. The truth of this claim entails that my theory, “all swans are white,” is false.**

Scenario 2



Magee 1985

Popper's Great Achievement

- **Even though empirical generalizations are not verifiable, they are falsifiable**

Induction is a Myth?

- **According to Popper, induction does not exist, no such thing**

Induction is a Myth?

- **Hume never claimed that induction was impossible or a myth, rather he argued it was a logically unfounded habit of the human mind**

Baconian Induction

“Rather than those old Baconian principles, now seen as hopelessly naive, scientists claim the “hypothetico-deductive” method as the core of the scientific process.”

– Niles Eldredge (2005)

“For all the vaunted worth of this method [the hypothetico-deductive] in science, it pays utterly no heed to where hypotheses come from in the first place...[It] is in fact rather bland and soulless...It is not where the grand ideas come from.”

– Niles Eldredge (2005)

Conclusion

- **Popper believed science advances by disproof**
- **Knowledge is provisional: nothing in science is permanently established**

Don't Be Overly Certain About Your Conclusions...

“I cannot give any scientist of any age better advice than this: the intensity of the conviction that a hypothesis is true has no bearing on whether it is true or not.” – **Peter Medawar (1979)**

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