

What is Scientific Knowledge ?

Scientific knowledge starts with **observations**. For example:

- On May 1st, Mars will appear bright red in the sky.
- The stick, partially immersed in the water, appears bent.
- The litmus paper turned red when immersed in the liquid.

What general (or universal) statements could be made from these singular observations? (Discuss)

In order to turn these observations into laws, what conditions must be satisfied?

- Number of observations must be large
- Observations must be repeated under a whole variety of conditions and must be able to be repeated by others.

This form of scientific reasoning is called induction or **inductive logic** (as opposed to deductive logic of axioms used in mathematics).

Induction means: *where a finite list of singular observations is used to justify a universal statement.*

INDUCTIVE LOGIC

Many times we did our experiments and found water boils at 100°C.

This water is boiling.

This water is at 100°C.

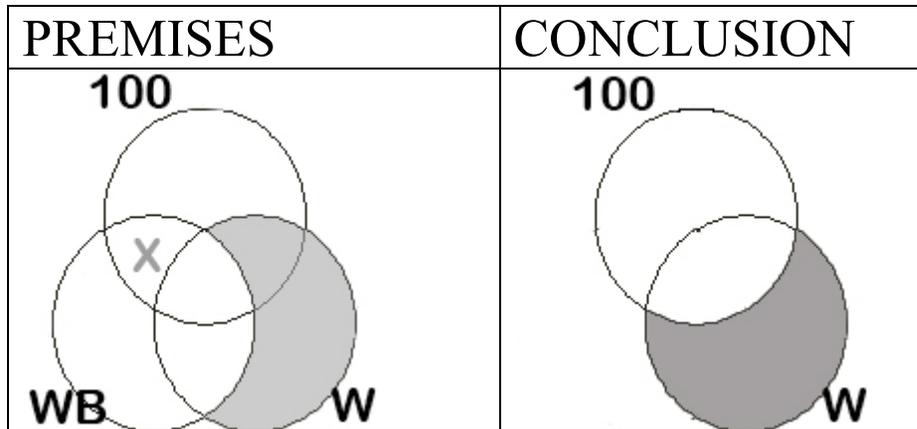
Let's write this in proper logical form and do a Venn diagram logical analysis.

Some water boils (WB) at 100°C.

All water (W) is WB.

All W is 100°C.

Let's do Venn diagrams!



INVALID!

Therefore inductive logic (logic of science) is invalid.

Science can be wrong (and science doesn't guarantee truth!)

How would the premise have to be written in order to make induction logically valid?

Answer: ALL water boils at 100 degrees Celsius.

Not possible to test all water, past and future.

THEREFORE, scientific induction is not logical. Science actually doesn't logically prove any of its theories or laws are true. Its dependence on probability cannot be used in making UNIVERSAL laws.

The Inductivist Turkey

e.g. There once was a smart turkey named Indy. This smart turkey named Indy was fed at 9 AM, every day, and thought to himself that there was no regularity in the weather when he was fed. Sometimes it was light and sometimes dull and sometimes cold and sometimes dark and sometimes warm and sometimes raining and sometimes snowing all at 9AM.

Can you help Indy to think like an inductivist?

On Thanksgiving Eve, Indy's throat was cut.

This is the Inductivist Turkey. It shows the main problem with Induction—there is no **guarantee** that what happens in the past will happen in the future.

David Hume (1711 – 1776) proved this long ago at University of Edinburgh in Scotland.

He decided that people's beliefs in inductive reasoning are dependent more on HABIT than on reasoning. We psychologically believe in induction.

The Gambler's Fallacy

Another relevant example is Gambler's Fallacy

Gambler's Fallacy – Imagine that you're flipping a coin, and it comes up tails 10 times in a row. What will happen next?

Psychologically common to think, however the 11th toss is not affected by the previous 10

There is no such thing as a hot slot machine that is about to give a jackpot because it hasn't given one in a while! Each pull is calculated independently of each other pull.

Stick to high percentage games like blackjack or roulette or fun games like craps...