# INFERENCE TO THE BEST EXPLANATION

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|---|---|
| *explanandum* | the thing explained |
| *explanans* | what does the explaining |
| explanation | one or more statements asserting why or how something is the case |

Vaughn says an explanation is not an argument (p. 337), but many disagree. Carl Hempel, an influential philosopher of science, argued that a scientific explanation is an argument where the conclusion describes the *explanandum*, the premises describe the *explanans*, and the argument is in one of 3 special forms. The best known of these forms is DN (deductive nomological) explanation: a deductively valid argument in which one of the premises is a (deterministic) law of nature

## Kinds of explanation

**functional** — also known as teleological

Explains something in terms of its function or purpose

*Example 1:* The purpose of brakes is to stop the car.

*Example 2:* The heart pumps blood that has picked up oxygen in the lungs to other parts of the body, where the oxygen is needed.

**interpretive** — Explains by saying what something means

*Example 1:* An isosceles triangle is a triangle with 2 sides of equal length where the third is a different length.

*Example 2:* Sam's silence means he'll go along with Greta's plan.

**procedural** — (or mechanical)

Explains something by saying how it happens or how it works, often by specifying the steps in a procedure or process

*Example:* In a radiant heating system, hot water runs through pipes in the floor or a radiator. Heat is transferred gradually from the water to pipes, from the pipes to the floor and then the air, or directly from the pipes in the radiator to surrounding air, thereby heating the room.

**theoretical** — (scientific explanation is of this type)

Explains something by appeal to a general theory or hypothesis, of the circumstances in which *explanandum* phenomenon occurred, a statement saying the *explanandum* occurred is true or probably true

## Inference to the best explanation as a type of argument

PATTERN Phenomenon Q (observed)
E provides the best explanation for Q
Therefore E is probably true

CRUCIAL STEP: E provides the best explanation for Q
A. Gap: This step itself requires argument in its defense
B. Evaluation should focus on this step, and support for it

## Re argument for middle step: E provides the best explanation for Q

**I. Minimal requirement: consistency**

internal consistency — no contradictions follows from the theory
external consistency — the theory is consistent with the data it is supposed to explain

**II. Criteria of adequacy of theories**

A. **testability**

1. There is a way to determine whether the theory is T or F.
2. A theory (hypothesis H) is testable if it predicts something other than what the theory was introduced to explain. (p. 352)
   It follows that the theory is ***FALSIFIABLE***: *there are some kinds of observations which, were they to occur, would show the theory is F*.
   For some (experimental or observation) conditions C and observable condition P, (H & C) → P is true.
   If P is false, then by Modus Tollens, ~(H & C)
   So by DeMorgan's Law, ~H ∨ ~C
   If C is true (experiment was as described), ~C is false, so ~H must be true (disjunctive syllogism), so H must be false.
   If P is true, that *supports* the truth of the theory, but in most cases *does not show that it must be true*.
   **FALSIFIABILITY is more important than VERIFIABILITY**

B. **fruitfulness** - the ability to predict unexpected phenomena
The measure of how fruitful a theory is: number of predictions it makes

C. **scope** - the diversity of phenomena explained (the number of entirely different phenomena explained

D. **simplicity -** (Ockham's razor) minimizing the number of
1. assumptions
2. categories of entities (ontological simplicity) that we don't have other reasons to accept

**The best theory** A. is internally and externally consistent
B. meets criteria of adequacy better than its competitors

## Evaluating theories (hypotheses)

The text's mnemonic: (p. 365)

1, State the **T**heory and check for consistency.
2. Assess the **E**vidence for the theory.
3. **S**crutinize alternative theories.
4. **T**est the theories with the criteria of adequacy.

1. Describe the (observed) phenomenon to be explained.

2. State the hypothesis proposed to explain the phenomenon.

### 3. Evaluate the hypothesis

A. Does it meet the minimal criteria of **internal & external consistency**?

B. **How strongly is it supported by relevant evidence?**

i. Apply criteria used for evaluating causal reasoning
   a. large # of cases supporting enumerative induction?
   b. strength of analogy to similar cases?
   c. strength of support using Mill's Methods?

ii. Methodology for collection of evidence
   a. sample: large enough? random?
   b. random assignment to groups and/or control for relevant factors
   c. replication of experiments?
   d. avoiding common sources of error
      poor conditions for making the relevant observations
      availability error
      tendency to see what we expect or want to see
      tendency to overlooking contrary evidence

iii. Credibility of defense of hypothesis
   a. appropriate authorities
   b. Do defenders have anything to gain from acceptance of hypothesis?
   b. peer reviewed
   c. are relevant details provided? hidden?