

Inductive Logic

Inductive Logic Overview

- (1) Distinguish inductive from deductive arguments
- (2) Define 'strength' and 'cogency'
- (3) Describe four kinds of inductive arguments
- (4) Practice exercises on inductive logic

Deductive and Inductive Arguments

Deductive vs Inductive

Deductive Reasoning

- Formal (the inference can be assessed from the form alone).
- When sound, the conclusion is *guaranteed* to be true.
- The conclusion is **extracted from** the premises.

Inductive Reasoning

- Informal (the inference *cannot* be assessed by the form alone).
- When cogent, the conclusion is only probably true.
- The conclusion **projects beyond** the premises.

Deductive vs Inductive: Certainty

Inductive arguments have conclusions that are uncertain...

- (1) This swan is white.
- (2) That swan is white.
- ∴ (3) The next swan I see will be white.

Deductive vs Inductive: Certainty

Inductive arguments have conclusions that are uncertain...

- (1) This swan is white.
- (2) That swan is white.
- ∴ (3) The next swan I see will be white.

... but so do many deductive arguments.

- (1) Alice owns a swan.
- (2) All swans are white.
- ∴ (3) Alice's swan is white.

With **inductive** arguments, the uncertainty lies in the inference.

With **deductive** arguments, the uncertainty lies in one or more of the premises.

Strength and Cogency

Strength

- A property of the argument.
- If an argument is strong, then the truth of the premises guarantees the *probable* truth of the conclusion.
- Unlike validity (which is all or nothing), inductive strength comes in degrees, and is determined by the content of the premises.

Cogency

- A property of the argument.
- If an argument is cogent, then (1) it is strong, and (2) all of its premises are true.

Strength and Cogency

Deductive Logic

- Valid/Invalid inferences
- Sound/Unsound arguments
- Conclusions are *guaranteed* true.

Inductive Logic

- Strong/Weak inferences
- Cogent/Uncogent arguments
- Conclusions are *probably* true.

Sample Inductive Arguments

Common Inductive Reasoning

Generalization

Inferring your beliefs about the whole of X from a part of X.

Authority

Inferring your beliefs about X from the beliefs held by a trusted source.

Analogy

Inferring your beliefs about a lesser known thing from its similarities with a better known thing.

Hypothetical Induction

Discovering the best explanation for some thing or event.

Argument from Generalization

(1) Token 1 of type A has property X.

(2) Token 2 of type A has property X.

Token = an individual
Type = a class of
individuals

∴ (3) All tokens of type A have property X. [or]

∴ (3') The next token of type A will have property X.

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Example: (1) The first Twinkie I ate from this box of 24 Twinkies had its crème filling riddled with mouse droppings. (2) The second Twinkie I ate from the box was similarly contaminated. (3) Likewise with the third Twinkie. (4) Therefore, the next (fourth) Twinkie I eat from this box will likely also have mouse droppings in its crème filling.

Argument from Authority

- (1) S (some person) is a reliable authority regarding P
(some statement).
- (2) S believes P.
- ∴ (3) P.

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Example: (1) Ed Smith has a Ph.D in physics, and (2) he believes that objects fall at the same rate regardless of weight, once air resistance is taken into account. (3) Therefore, it's probably true that objects fall like that.

Argument from Analogy

- (1) Items A and B have property X.
- (2) A also has property Y.
- ∴ (3) B also has Y.

A = Primary Analogate

B = Secondary Analogate

X = shared property that is known.

Y = shared property that is inferred.

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X = shared property that is known.

Y = shared property that is inferred.

Example: (1) Jane and Nancy both received National Merit Scholarships, both are math majors, and both like Dr. Rich's classes.
(2) Jane received an A in Dr. Rich's Calculus II class last semester, so
(3) Nancy should do equally well in the same class this coming semester.

Six Rules for Strong Analogies

- (1) **Relevance:** Relevance of the known shared property (x) to the inferred shared property (y). [The more relevant, the stronger the analogy.]
- (2) **Disanalogy:** Nature and degree of disanalogy, i.e., differences between the primary and secondary analogates. [Usually, the more disanalogies, the weaker the analogy.]
- (3) **Similarities:** Number of similarities between primary and secondary analogates. [The more similarities, the stronger the analogy.]
- (4) **Sample size:** Number and kind of primary analogates. [The more samples, the stronger the analogy.]
- (5) **Sample diversity:** Diversity among the primary analogates; randomized sampling strengthens the likelihood of the secondary analogate sharing the contested property. [Usually, the greater the number, the stronger the analogy.]
- (6) **Specificity:** Specificity of the conclusion relative to the premises. [The more specific the conclusion, the weaker the analogy.]

Analogy: Applying the Rules

Jane and Nancy both received National Merit Scholarships, both are math majors, and both like Dr. Rich's classes. Jane received an A in Dr. Rich's Calculus II class last semester, so Nancy should do equally well in the same class this coming semester.

- (1) **Relevance** All three stated similarities are relevant. [strengthens]
- (2) **Disanalogy** Suppose Jane's SAT math was 800, while Nancy's was only 450. [weakens]
- (3) **Similarities** Suppose there are more similarities, e.g., Jane and Nancy have always performed equally well in their math classes. [strengthens]
- (4) **Sample size** Suppose Al, Betty, and Carl also share these same properties with Jane. [strengthens]
- (5) **Sample diversity** Suppose all four differ on many other characteristics, some of which Nancy shares, others she does not. [strengthens]
- (6) **Specificity** We change the claim to: Nancy will get at least a B. [strengthens]

Hypothetical Induction

(abduction)

- (1) P (some surprising phenomenon).
 - (2) If H (some hypothesis), then P.
 - (3) H is the best available explanation of P.
- ∴ (4) H.

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Example: (1) The left-over pizza has been eaten. (2) If John stopped by, then he would have eaten it. (3) I can't think of anyone else who might have eaten my pizza without asking. Therefore, (4) John must have stopped by and eaten my pizza.

Explanation to the Best Inference

Hypothetical induction (abduction; explanation to the best inference) is the **positing of some theoretical entity or structure** in order to explain some observed phenomenon (a “**surprising fact**”).

The hypothesis is meant to **explain** the observed phenomenon, so that if the explanation were *true* then the fact would no longer be surprising.

Practice Arguments

Practice Argument #1

Every time I eat at Ed's Diner, the coffee has been wretched, so the coffee will likely be wretched today as well.

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Every time I eat at Ed's Diner, the coffee has been wretched, so *the coffee will likely be wretched today* as well.

Generalization, strong.

Practice Argument #2

This lovely china plate is similar in size, weight, and composition to the one I just dropped on your head, and that one broke. Therefore, it stands to reason that when I drop this plate on your head, it too will break.

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Practice Argument #3

“A dog was kept in the stables, and yet, though someone had been in and had fetched out a horse, he had not barked enough to arouse the two lads in the loft. Obviously the midnight visitor was someone whom the dog knew well.” [Arthur Conan Doyle, *Memoirs of Sherlock Holmes*]

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Hypothetical

Practice Argument #4

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Authority, weak.

Practice Argument #5

A porpoise is similar to a human being. It has lungs rather than gills. It is warm-blooded rather than cold-blooded. And porpoises nurse their young with milk. Therefore, porpoises, like humans, are probably capable of speaking languages.

Practice Argument #5

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Analogy, weak.

Practice Argument #6

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Generalization, weak.

(Hasty Generalization)

Practice Argument #7

Dr. Blithers, an internationally respected paleontologist, told me that the massive dinosaur die-off was most likely the result of an asteroid colliding with the earth. What's more, this hypothesis enjoys widespread support in the scientific community. So my guess is that it's true.

Practice Argument #7

Dr. Blithers, an internationally respected paleontologist, told me that the massive dinosaur die-off was most likely the result of an asteroid colliding with the earth. What's more, this hypothesis enjoys widespread support in the scientific community. So *my guess is that it's true.*

Authority, strong.

Practice Argument #8

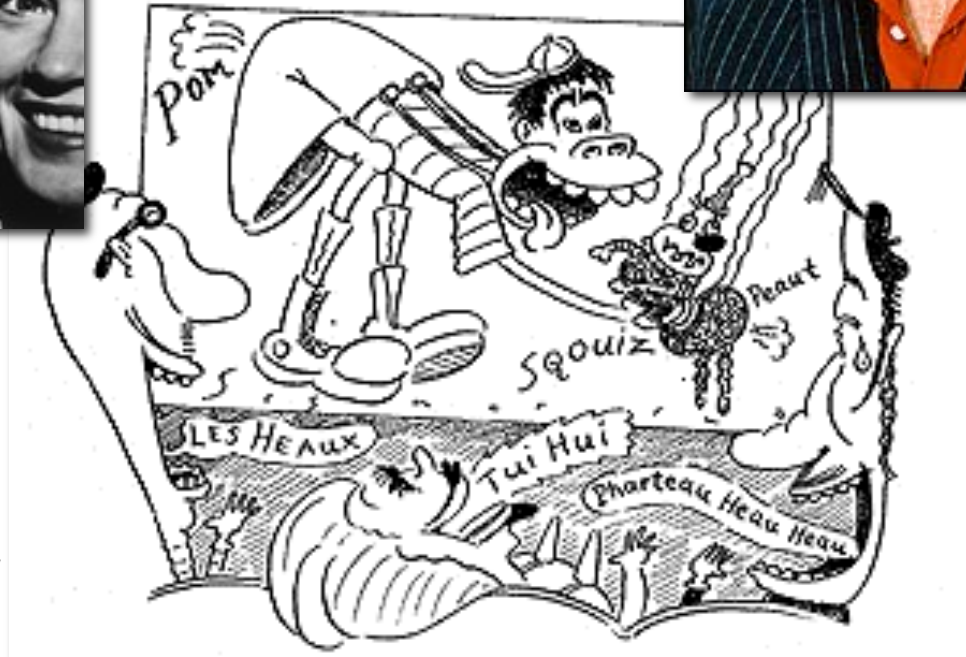
Every time I hear the garbage can tip over and I run out to check on it, I discover a raccoon inside the can looking for some dinner. That was the can falling over just now, so I suspect we'll find a raccoon if we go out and check.

Practice Argument #8

Every time I hear the garbage can tip over and I run out to check on it, I discover a raccoon inside the can looking for some dinner. That was the can falling over just now, so I suspect we'll find a raccoon if we go out and check.

Generalization, strong

Jerry Lewis?



Do the French really love Jerry Lewis? Yes.

<http://www.straightdope.com/classics/a991001.html>