Philosophy of Science

Lecture 2: Induction
Special Topic: The New Riddle of Induction

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The Problem of Induction

The principle of the uniformity of nature

- In the *Enquiry*, Hume claims that the principle of uniformity of nature underlies all inductive inferences.

- Consider the following example of an inductive inference:

1. All hitherto observed ravens are black.

Therefore, all ravens are black.

The principle of the uniformity of nature

- In the *Enquiry*, Hume claims that the principle of uniformity of nature underlies all inductive inferences.

- Consider the following example of an inductive inference:

  1. All hitherto observed ravens are black.
  2. Ravens (particularly their colour) are uniform.
  Therefore, all ravens are black.

- That is, on the assumption that the properties of the said objects do not vary, we can conclude: all ravens are black.

- There are various versions of the principle. Here's a general one: ***The future resembles the past.***

Doubting uniformity

- Hume denies this principle by pointing to cases where the future differs from the past.

  NB: He doesn't claim that the world is entirely non-uniform.

- Indeed, he suggests that experience of some uniformity (in the form of correlations) leads to a 'habit of the mind'

- This makes us anticipate future events through induction.

- In short, it is not a worldly uniformity but a projected one that underlies induction (and causal inference).

Doubting uniformity: Russell's chicken

- The following example is instructive in showing that the future need not always resemble the past.

"We know that all these rather crude expectations of uniformity are liable to be misleading. The man who has fed the chicken every day throughout its life at last wrings its neck instead, showing that more refined views as to the uniformity of nature would have been useful to the chicken" (1912: p. 21).

Justifying induction: A dead-end?

- Hume argues that we cannot justify induction. Neither a deductive nor an inductive justification succeeds.

  “The question of justification is then the question of showing that nature is indeed uniform. This **cannot be deduced** from what we have observed, since the claim of **uniformity itself incorporates a massive prediction**. But the only other way to argue for uniformity is to use an **inductive argument**, which would rely on the principle of uniformity, leaving the **question begged**” (Lipton 1991: 416) [boldness added].

Anti-Inductivism and its Critics

Popper's rejection of induction

- Popper ([1934]1959) argues that induction has no place in science. Rather science proceeds by:

  Conjectures (in the context of discovery) and

  Refutations (in the context of justification)

- No such thing as:

  (i) the construction of hypotheses through induction and

  (ii) the inductive support of hypotheses.

Refutation vs. corroboration

- A hypothesis is either refuted or is ‘corroborated’ - the latter means it has survived so far and is tentatively accepted.

corroboration does not equal confirmation

“The best we can say of a hypothesis is that up to now it has been able to show its worth, and that it has been more successful than other hypotheses although, in principle, it can never be justified, verified, or even shown to be probable. This appraisal of the hypothesis **relies solely upon deductive consequences** (predictions) which may be drawn from the hypothesis: There is no need even to mention ‘induction’.”(p. 315) [emphasis added].

Using deduction in search of refutations

- From Salmon et al. (1999, p. 45):

  1. Boyle's law: At constant temperature, the pressure of a gas is inversely proportional to its volume.
  2. The initial volume of the gas is 1 cubic ft.
  3. The initial pressure is 1 atm.
  4. The volume is decreased to 1/2 cubic ft.
  5. The temperature remains constant.

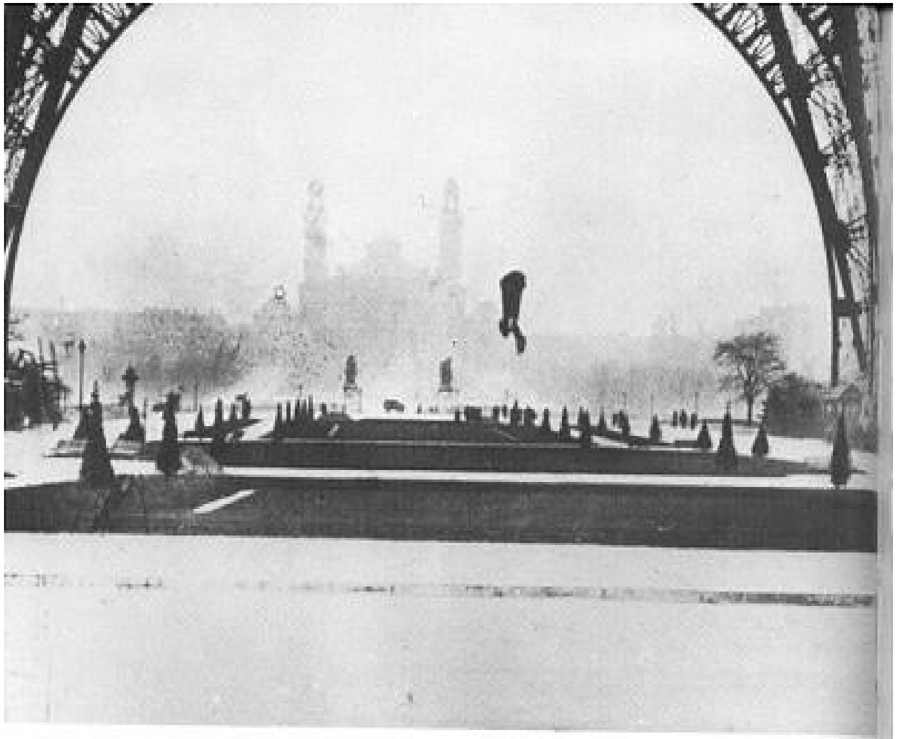
  $\therefore$ The pressure increases to 2 atm.

  atm (standard atmosphere): a unit equivalent to the mean sea-level atmospheric pressure on our planet.

The floater objection

- **Worrall (1989)**:

  A guy called ‘floater’ argues (on Popperian grounds) that taking the lift down from the top of the Eiffel tower is **no more rational** than jumping off and expecting to land safely since the evidence **does not entail** either a safe or an unsafe outcome.



The moment before Franz Reichelt died jumping from the Eiffel Tower with his parachute overcoat, 1912.

The floater objection: Explained

- Recall that Popper insists that a hypothesis is never confirmed but only corroborated.
- Indeed, he insists that hypotheses, even corroborated ones, cannot be said to be true or even probably true.
- Thus, we cannot say ‘The Floater falling from the Eiffel Tower will die’ is true or probably true. That seems absurd!
- **Possible reply**: Popper (1972) argues that one should guide future action on the basis of the best corroborated theories.
- **Problem**: Why follow the best corroborated theories? Because they worked in the past. Induction returns!!!

Popper believes that there is ______ in the context of ______.

a logic, discovery

no logic, justification

a logic, invention

a logic, justication

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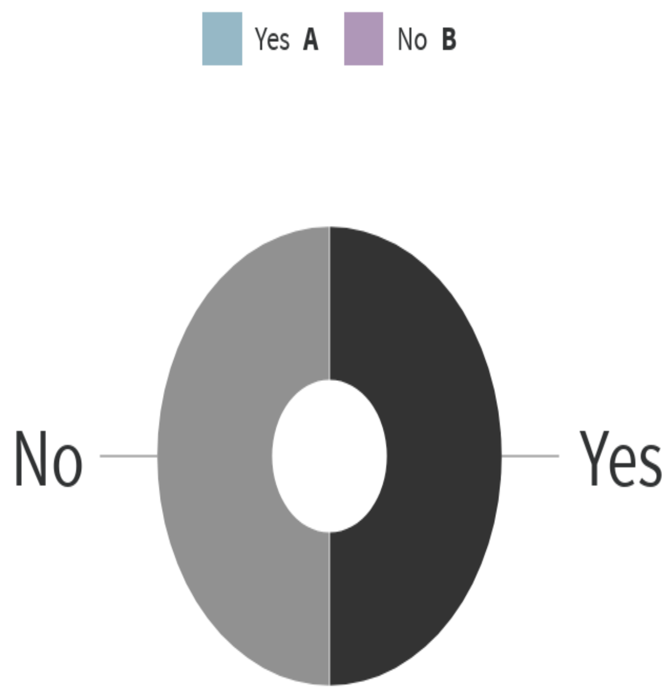
In your view, can induction be completely avoided in science?



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A Virtuous Justification?

A virtuous-circular justification of induction?

- Some philosophers draw a distinction between vicious and virtuous circularity.
- The latter has been used in an attempt to justify induction via induction (see, for example, Ladyman and Ross 2007).
- To be precise, the idea is that a rule-circular, as opposed to a premise-circular, argument is virtuously circular.

  Premise-circularity: An argument where one of the premises presupposes the truth of the conclusion.

  Rule-circularity: An argument where the inference rule presupposes the truth of the conclusion.

A virtuous-circular justification of induction?

- **Rule-circular justification of induction**:

  1. Past inductions have been successful.
  ------------------[by the inductive rule]----
  ∴ Inductions will be successful in the future.

Salmon’s objection: Counter-induction

- Salmon (1957): Suppose ‘counter-induction’ to be a method of reasoning that is the opposite of induction.

- Counter-induction counsels that the future will be unlike the past & that the unobserved will be unlike the observed.

- *Example*:

  All observed ravens are black.
  ∴ The next raven to be observed will be white.

Salmon's counter-induction

- How does the counter-inductivist justify their view?

- The counter-inductivist should also be allowed to justify their view counter-inductively via a rule-circular argument.

- **Rule-circular justification of counter-induction**:

  1. Past counter-inductions have been unsuccessful.
  --------------------[by the counter-inductive rule]----
  ∴ Counter-inductions will be successful in the future.

- **Punchline**: Rule-circularity leads us to conflicting claims, viz. inductions/counter-inductions will be successful.

How does rule-circularity differ from premise-circularity?

Special Topic:
The New Riddle of Induction

Grue and bleen

- Various versions of this puzzle, which originates in Goodman (1954). The following is adapted from Sober (2001).
- Two languages, *L* (English) and *L*´ (a variant). *L*´ replaces the predicates 'green' and 'blue' with 'grue' and 'bleen'.
- Thankfully we are given a translation manual:

  x is **grue** IFF *x* "is green and the time is before [*t*] or [it] is blue and the time is after [*t*]" (p. 5).

  x is **bleen** IFF *x* "it is blue and the time is before [*t*] or it is green and the time is after [*t*]" (p. 5).

  where *t* is some future fixed time.

Evidential statements in each language

- Suppose we made some observations of emeralds prior to *t* and found that all were green.
- We would presumably be inclined to accept the following evidential statements:

E_1: Emerald a_1 is green.
E_1': Emerald a_1 is grue.
…
E_n: Emerald a_n is green.
E_n': Emerald a_n is grue.

Equally well-supported hypotheses

- Now consider the following two hypotheses:

  H_1: The next emerald to be examined after t will be green.
  $H_1´$: The next emerald to be examined after t will be grue.

- The two hypotheses seem equally well supported:

  E_1 to E_n inductively support H_1.
  $E_1´$ to $E_n´$ inductively support $H_1´$.

- H_1 and $H_1´$, however, make contradictory predictions since to be a grue emerald after t means to be blue, not green!

General hypotheses

- The same puzzle holds for the following more general hypotheses:

H_2: All emeralds are green.
$H_2{}'$: All emeralds are grue.

NB: That is, the evidence *so far* supports both hypotheses.

A matter of derivative vs. basic?

- It is tempting to dismiss ‘grue’ and ‘bleen’ by claiming that they are derivative as opposed to basic.

- But we can give translation rules that reverse this role:

  x is **green** IFF it is grue and the time is before *t* or it is bleen and the time is after *t*.

  x is **blue** IFF it is bleen and the time is before *t* or it is grue and the time is after *t*.

- If we start from *L*´, then the predicates of *L* look derivative.

A matter of derivative vs. basic? (2)

- For the same reasons, it *seems* that we cannot claim that ‘grue’ and ‘bleen’ contain a temporal restriction.
- **Upshot 1**: Predicate choice seems to affect the ‘goodness’ of inductive inferences.
- **Upshot 2**: The puzzle attacks our ability to identify so-called ‘natural kind’ terms.
- Roughly, a term denotes a natural kind in case there is a corresponding class of things in nature.

  NB: The apt expression here is ‘nature is cut at-the-joints’.

Goodman's own solution

- Goodman: Our predicates are chosen because of entrenchment and the projectibility of hypotheses.

- Cohnitz & Rossberg (2014):

  "… in the past we projected many more hypotheses featuring 'green' or predicates co-extensional with 'green' than hypothesis featuring the predicate 'grue'. If two hypotheses are the same with respect to their empirical track-record, then the hypothesis that uses the better entrenched predicates overrides the alternatives".

- Needless to say, the debate rages on - see Elgin (1997).

The End