

A Note on the Use of “Induction” and “Deduction” in Sociological Methodology

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analytické metódy v spoločensko-humanitných disciplínach
analytical methods in social sciences and humanities

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Analytical Methods in Social Sciences and Humanities (SSH)

Hypothesis

“[...] Analytical methods thus fulfill similar methodological functions in SSH and in natural sciences, and also share the same formal and application properties [...]”

- **analytical methods:** non-empirical methods including defining, modelling, inference, classification...
- **SSH:** represented by economics, sociology, jurisprudence, philosophy, historical disciplines

Outline

Main message

Many textbooks in the methodology of social science are based on antiquated or confused views of “induction” and “deduction”.

Outline

- 1 Induction and deduction in traditional and modern logic
- 2 Induction and deduction in the methodology of social science
- 3 Exogenous vs. endogenous methodology of social science

Logic: traditional vs. modern

Traditional logic

- an amalgam of logical, methodological and epistemological views on “correct thought”
- classical formulation: Arnauld – Nicole: *Logic or the Art of Thinking* (the Port-Royal logic, 1662)
- sources: Aristotle’s study of syllogistic reasoning and many medieval, renaissance and early modern contributions

Modern logic

- a formal (analytical, non-empirical) discipline which investigates: the form of correct arguments or (more specifically) the relation of entailment.
- classical formulation: e.g., Russell – Whitehead: *Principia Mathematica* (1910)
- precursors: A. De Morgan, G. Boole, G. Frege, B. Russell

Logic: traditional vs. modern

Traditional logic

- 1 logic as “the science of **correct thought**”
- 2 deduction as moving “from the **general** to the **particular**”
- 3 induction as moving “from the **particular** to the **general**”
- 4 deduction and induction as **modes of inference**
- 5 focus on deduction

Modern logic

- 1 logic as the study of **entailment**
- 2 deduction as inference in which the conclusion is **entailed** by the premises
- 3 induction as inference in which the conclusion is **supported** by the premises
- 4 deduction and induction as **modes of inference**
- 5 focus on deduction

Some examples

Deductive, valid, general to particular

All men are mortal.

Socrates is a man.

Socrates is mortal.

Inductive, somewhat plausible, particular to general

Raven no. 1 is black.

Raven no. 2 is black.

...

Raven no. n is black.

All ravens are black.

Some counterexamples

(to traditional logic)

Deductive, valid, ~~general to particular~~

Socrates is a man.

Socrates is a man or Plato is an astronaut.

Deductive, valid, ~~general to particular~~

It is raining and it is not raining.

Aristotle was Socrates' father.

Deductive, valid, ~~general to particular~~

$$x + 1 = 3$$

$$x = 2$$

(Supposing the standard meanings of 1, 2, 3, +, =)

Some counterexamples

(to traditional logic)

Inductive, by analogy, ~~particular to general~~

Candidate *A* had the wealthiest sponsors and won the vote.
Candidate *B* had the wealthiest sponsors and won the vote.
Candidate *C* has the wealthiest sponsors.

Candidate *C* will win the vote.

Inductive, statistical, ~~particular to general~~

The probability that a Greek citizen is a philosopher is 98%.
Socrates is a Greek citizen.

Socrates is a philosopher.

Some counterexamples

(to traditional logic)

Inductive, enumerative, ~~particular to general~~

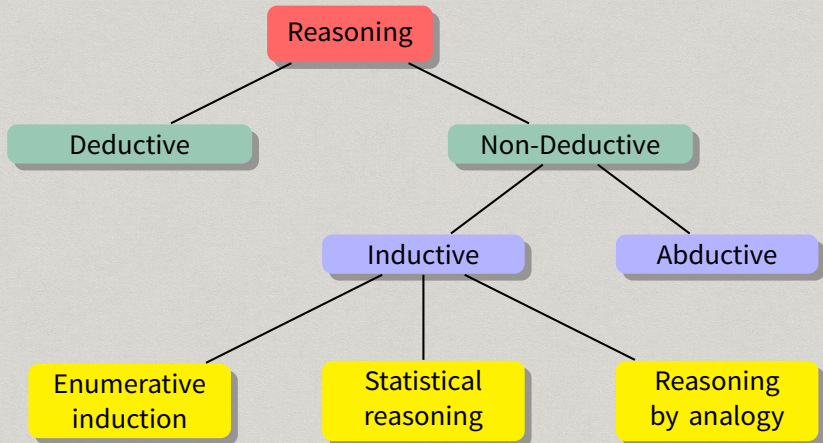
All observed ravens have been black.

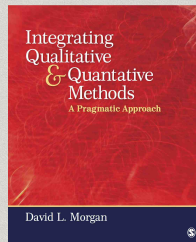
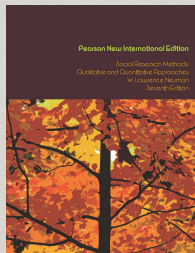
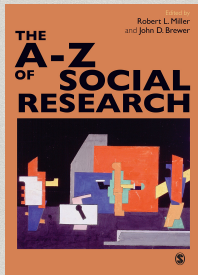
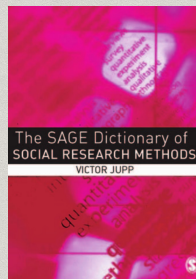
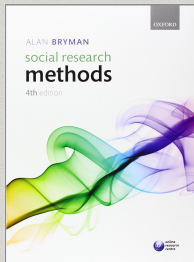
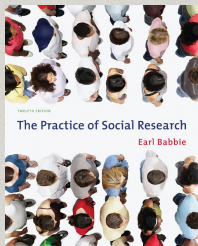
All ravens are black.

(Implicitly, of course, this *is* “particular to general” as in all cases of enumerative induction.)

Summary

- In modern logic, the “extent” of the premises and conclusions (i.e., whether they are “general” or “particular”) plays **no special role**.
- The key criterion for classifying arguments is the **relation of logical entailment**.
- In deductive arguments, the conclusion is **entailed** by the premises. The informational content of the conclusion is merely “**analytically new**” vis-a-vis the informational content of the premises.
- In inductive arguments, the conclusion is not entailed by the premises, but the latter provide some **degree of support** to the former. Inductive inference is **ampliative**.





Three problems

- 1 outdated and/or confused views of induction and deduction
- 2 induction and deduction as methods of theory construction or testing
- 3 induction and deduction as related to the qualitative – quantitative divide

Views of induction and deduction

- “To deduce means to draw logical conclusions by a process of reasoning; deduction is the process of reasoning by which logical conclusions are drawn from **a set of general premises**.” (Miller – Brewer, 2003, 67)
- “Induction, or inductive reasoning, moves **from the particular to the general**, from a set of specific observations to the discovery of a pattern that represents some degree of order among all the given events.” (Babbie, 2010, 22)
- “[Induction is a] form of reasoning from statements about observed cases to statements about other, unobserved, cases or – more usually – to **a general claim** about most or all cases of the same kind.” (Jupp, 2006, 146)

Views of induction and deduction

- “...Deductive (**abstract to concrete**), inductive (**concrete to abstract**)...” (Neuman, 2014, 87)
- “Subsumption proceeds from an already known context of features, that is from a familiar *rule* [...], and seeks to find this general context in the data [...]. The logical form of this intellectual operation is that of *deduction*: the **single case in question is subordinated to an already known rule**.” (Flick et al., 2004, 160 – 161)
- “A second form of analysis consists of extending, or **generalizing**, into an order or rule the combinations of features that are found in the data material. The logical form of this intellectual operation is that of **quantitative induction**.” (Flick et al., 2004, 161)

Views of induction and deduction

Summary

- Inductive inference is identified with enumerative induction.
 - **reasoning by analogy** and **statistical reasoning** are left out
- Examples of deductive inference are usually limited to a single argument form:

All S are P.

a is S.

a is P.

Induction, deduction, theory construction, and testing

- “[Induction] is contrasted with deduction (or **the hypothetico-deductive model**), which is reasoning from a general premise (for example, ‘all humans die’), plus a statement about some particular case (‘Socrates is human’), to a further conclusion about that case (‘Socrates is mortal’).” (Jupp, 2006, 146)
- “deduction or deductive reasoning [...] moves from the general to the specific. It moves from (1) a pattern that might be logically or theoretically expected to (2) **observations** that test whether the expected pattern actually occurs.” (Babbie, 2010, 23)

Induction, deduction, theory construction, and testing

The Hypothetico-Deductive Model of Theory Testing

- 1 Specify the hypothesis H !
- 2 Deductively derive the test implications T_1, T_2, \dots, T_n from the hypothesis H and auxiliary assumptions A_1, A_2, \dots, A_n !
- 3 Design and run an **empirical test** of the test implications T_1, T_2, \dots, T_n !
- 4 If the test is positive, declare the conjunction of the hypothesis H and the auxiliary assumptions A_1, A_2, \dots, A_n to be corroborated!
- 5 If the test is negative, declare the conjunction of the hypothesis H and the auxiliary assumptions A_1, A_2, \dots, A_n to be falsified!

The H-D model (or the H-D method) is **not** merely a form of reasoning!

Induction, deduction, theory construction, and testing

“Deductive Theory Construction

- 1 Specify the topic.
- 2 Specify the range of phenomena your theory addresses. Will your theory apply to all of human social life, will it apply only to U.S. citizens, only to young people, or what?
- 3 Identify and specify your major concepts and variables.
- 4 Find out what is known (propositions) about the relationships among those variables.
- 5 **Reason logically from those propositions to the specific topic you're examining.** (Babbie, 2010, 54)

Induction, deduction, theory construction, and testing

Summary

- Sometimes, **deduction** is identified with the **hypothetico-deductive model**, while **induction** is identified with an alternative method of theory construction (**grounded theory**).
- This is justified by the old “general to particular”, “particular to general” metaphor.
- However, methods of theory construction/testing are **not** simply methods of reasoning.
- Various kinds of reasoning may be applied in both cases.

Induction, deduction, quality, and quantity

Generally speaking...

- **quantitative research** is a research strategy oriented towards quantification, i.e., measurement of magnitudes of interest and their expression by means of ordinal, interval or ratio values; it is characterized by the use of quantitative, e.g., statistical methods.
- **qualitative research** is a research strategy which does not aim at quantification, and may instead emphasize, e.g., the analysis of meaning ascribed by agents to their actions, institutions, etc.

Table 2.1

Fundamental differences between quantitative and qualitative research strategies

	Quantitative	Qualitative
Principal orientation to the role of theory in relation to research	Deductive; testing of theory	Inductive; generation of theory
Epistemological orientation	Natural science model, in particular positivism	Interpretivism
Ontological orientation	Objectivism	Constructionism

(Bryman, 2012, 36)

Table 1.1**Comparing Qualitative and Quantitative Research**

Qualitative Research	Quantitative Research
Induction	Deduction
Subjectivity	Objectivity
Context	Generality

(Morgan, 2014, 9)

Induction, deduction, quality and quantity

Summary

- Sometimes, **induction** is identified with **qualitative research**, while **deduction** is identified with **quantitative research**.
- However, there are **no logical reasons** for this: both forms of reasoning allow for qualitative *and* quantitative predicates.
- **Statistical reasoning** (which involves quantities) is a form of **inductive** reasoning. On the other hand, **Bayesian reasoning** (which also involves quantities) is **deductive**.
- As regards theory construction, the H-D model also allows for qualitative predicates: there is no necessary connection to quantitative research.

Exogenous vs. endogenous methodology

Methodology in the academic division of labor

- **endogenous:** stems from the discipline itself
 - practicing scientists who reflect on their own activity
 - designated methodologists within departments, but with a specialization in the field
- **exogenous:** outsiders at the crossroads of logic, epistemology and the philosophy of science
 - general philosophy of science
 - specialized branches (outside the respective fields): philosophy of physics, biology, economics, ...

Exogenous vs. endogenous methodology

- (Does this distinction apply more to social than to natural science?)
- In social science, the two methodologies develop more or less independently:
 - **endogenous methodology** is in perhaps closer contact with cutting edge research in the respective fields,
 - **exogenous methodology** follows the development in logic, semantics and philosophy more closely.

Babbie, Earl	Behavioral Sciences
Brewer, John D.	Post Conflict Studies
Bryman, Alan	Management
Flick, Uwe	Social Science and Education
Jupp, Victor	Criminology
Kardorff, Ernst von	Sociology
McMurray, Adela	Management
Miller, Robert L.	Social Welfare
Morgan, David L.	Professional Psychology
Neuman, W. Lawrence	Sociology
Pace, R. Wayne	Organizational Leadership
Scott, Don	Management
Steinke, Ines	Marketing Psychology

Why is this important?

- 1 Artificial differences in terminology complicate communication across fields.
 - Induction and deduction are just one example; consider the use of “model” and “theory” in social science.
- 2 More practically, students who take courses in endogenous methodology often face difficulties with the modern notions of induction and deduction when taking a course in exogenous methodology or logic.

Thank you!



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