University of Oxford
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Philosophy of the Social Sciences: Lectures
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Lecture 4: **SCIENTIFIC THEORY I**

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The Problem *Some philosophers argue that the only criterion for judging that a theory is 'scientific' as opposed to 'pseudo-scientific' or 'metaphysical' is whether scientists say it is. Yet this seems to violate the ideal of scientific knowledge as rationally based or cognitively based rather than based on power or being a social matter.*

Summary

1. Background to the problem
2. Key concepts
3. Mill:
   - science and logic
   - science and laws
   - inductive logic and physical science
   - deductive logic and social science
4. Hume and the problem of induction
5. The probability solution to the problem of induction
6. Popper
   - scientific method as deductive
   - falsifiability
7. Kuhn
   - the demarcation of science from pseudo-science
   - criticism of falsification
   - conceptual indeterminacy
   - the community of scientists
   - paradigms
   - theory choice

Key concepts

1. **Scientific** - adj.
   What does it mean to say a 'fact' is a 'scientific fact'?

1.1. It is a fact whose factuality and articulation as such is due solely to the proceedings and persuasiveness of science. Insofar as it is true that we accept it as a fact that, eg, 'the earth and other planets revolve around the sun' because of the efforts of science, then this is a scientific fact.

1.2. There are other 'facts' whose factuality and articulation has nothing to do with science: 'this table is before me' is a fact which seems to follow simply from my, and your, sense experience; that 'grain crops need water' is a fact known through simple human practices like agriculture. Nothing scientific, as such, about them.

1.3. But the complex explanation of the role of water in plant reproduction and growth, the one that is now most widely accepted, is a scientific rather than commonsensical one. And the scientific explanation of the relationship between water and grain crops is in turn systematically connected to a wider body of knowledge of biochemistry

2. **Scientific -** (adj.) **Theory –** (n.)

2.1. theory as opposed to fact (theory sets out to explain facts);
theory as opposed to observations (observations test the theory);

2.2. a theory has a propositional structure (gram.) – it is a set of propositions

2.3. a theory is an argument

2.4. a theory is hypothetical (modality) – it describes a 'possible world'; the 'possible world' might be actual

2.5 Here is an example of a scientific theory: 'There is a black hole at the centre of our galaxy'. What makes it 'scientific'?

2.5.1 It's a theory that has emerged in the course of scientific practice – you need to be somewhere in the social structure of science in order to come up with it (*science as a set of social institutions*)

2.5.2 It's a theory that can be further refined and tested by science (*science as a technical practice*)

but

2.5.3 Scientific theories can also be approached in a non-scientific way (eg 'Ohmigod, that's terrible').

Who has said what about all this?

3. **J S Mill** (1806-1873)

3.1. 'Any facts are fitted, in themselves, to be the subject of science, which follow one another according to constant laws; although those laws may not have been discovered nor even be discoverable by our existing resources'. Logic of the Moral Sciences

3.2 **Inductive methods**

from observation,
to controlled experiment,
to discovery of cause-effect relations,
to establishment of laws.

3.3. **Physical sciences are inductive.**
Social science is deductive, not inductive.

p83 *'It infers the law of each effect from the laws of causation on which that effect depends; not however from the law merely of one cause, as in the geometrical method; but by considering all the causes which conjunctly influence the effect, and compounding their laws with one another.'*

p84: '*actions and feelings of human beings in the social state are, no doubt, entirely governed by psychological and ethological laws; .... Supposing therefore the laws of human actions and feelings to be sufficiently known, there is no extraordinary difficulty in determining from those laws the nature of the social effects which any given cause tends to produce.'*

However, there is the difficulty of **interaction of laws and tendencies**

p85: Remedy: ***verification:*** *collating the conclusion of the ratiocination either with the concrete phenomena themselves, or, when such are obtainable, with their empirical laws.*

*1.deduce conclusions by reason, verify by observation (**Direct Method)***
*2.obtain conclusions provisionally from experience, connect with principles/laws by a priori reasoning **(Inverse Method)***
p86 Because there are many countervailing laws/tendencies – sociology cannot aspire to 'be a science of positive predictions'
p87 'The mode of production of all social phenomena is one great case of Intermixture of Laws'.
p88 'All the general propositions which can be framed by the deductive science are , therefore, in the strictest sense of the word, hypothetical.'

4. **Karl Popper** (1902-1994)

4.1 **David Hume** (1711-1776) had shown that there is **no rational or logical basis for induction**. Inductive inference rests on the premise that the future will be like the past. There is no rational logical basis for this premise. We cannot infer from current and past experience to future experience. We cannot infer from any particular proposition about a given class of events or phenomena to a universal proposition about the universal class. Repetition has no logical power as an argument. However it dominates our psychology. It governs our expectations and responses to stimuli. The logical problem is not addressed by the substitution of our certainty that the past will be like the future by the weaker probability that the past will be like the future. Neither of these psychological/cognitive/subjective states has any logical support. Logic is the basis of rationality, the guiding principle of rationality. Therefore, the belief that future will be like past , and all induction, is non-rational or irrational.

4.2. **Popper** argues that **verification** falls foul of the philosophical problem of induction.

4.3. However, **falsification** does not – a single falsifying instance falsifies a universal just as it does a particular theory. So the **method of falsification** preserves the logic of scientific discovery. It is not invalid as Mill's logical inductivism is. It means that scientific discovery IS a very particular species of discovery. Science is set apart from craft, art, and ordinary human practices. It is set apart from pseudo-sciences like marxism, psychoanalysis, astrology and alchemy. These do not conform to the procedures of falsificationism.

5. **Thomas Kuhn** (1922-1996)

5.1 Principle of falsificationism does not describe what scientists do
5.2 Falsification is as problematic, logically and epistemologically, as verification, because of

- conceptual indeterminacy
- lack of empirical specification (operationalisation) of theoretical concepts
- reliance on exemplars

5.3 Ontological importance of 'the community of scientists'
Elster: What counts as science? '*A discipline has become a science when (1) there is general agreement among its practitioners at any point on what is true, what is false, what is conjectural, and what is unknown within its domain; (2) there is a process of cumulative progress by which theories and explanations, when discarded, are discarded forever; (3) the main concepts and theories can be expressed in terms clear and explicit enough to be understood by anyone who is willing to expend time and effort; and (4) the 'classics' of the discipline are read mainly by historians of sciences.*[p.445]

5.4 The operation of '**paradigms'**

- all the shared commitments of a scientific group
- a subset of these commitments consisting of
    - symbolic generalisations
    - models, analogies and heuristics
    - ontology and metaphysics
    - exemplars

5.5 **Theory choice** (Kuhn's 'five ways')

- accuracy
- consistency (internal and external)
- scope
- simplicity
- productiveness
    - these will not co-vary
    - there will be trade-offs
    - criteria of choice can function as values when incomplete as rules

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J S Mill on the inapplicability of inductive methods to social science

[see *Logic of the Moral Sciences* pp66ff}

1. Mill uses the following example of a commonplace and invalid use of inductive inference in the context of political economy:
'the prohibition of foreign commodities must conduce to national wealth, because England has flourished under it, or because countries in general which have adopted it have flourished;'

Premisses:	England has (had) prohibition of foreign commodities (PFC)
	England has great national wealth (GNW)
	Countries B, C, D.... have (had) prohibition of foreign commodities
	Countries B, C, D.... have great national wealth
Conclusion	* Prohibition of foreign commodities causes great national wealth
	(*: invalid)

2. We can set this 'theory' out as a set of variables and cases:

Var:	**Case:**	**England**	**Case B**	**Case C**	**Case D**
PFC	Y	Y	Y	Y	Y
GNW	Y	Y	Y	Y	Y

3. Mill argues that 'the cause of GNW must be complex'.

4. In order to establish causal chains, we need to
- introduce other variables
- analyse out aspects of PFC, GNW and other variables
- set up cases where single variables vary while all others are constant.....

5. In social science we can't conduct experimentation (unlike eg chemistry)

6. Proceeding by finding cases where variables have different values (ie the 'comparative method') is also fraught with difficulty and contradiction:-

6.1 Method of Difference

	A	B
Natural endowment	High	High
Laws	Yes	Yes
Resp Govt	Yes	Yes
Culture	Wonderful	Wonderful
Tariffs	Yes	No
GNP/gnw	Hi	Lo

'two nations which agree in everything except their commercial policy would agree also in that' (LMS p68)
[in contemporary methodological terms the problem here, and in some other examples below, is that the research design 'samples on the dependent variable' – ejf]

6.2. Indirect Method of Difference

	A	B	C
Natural endowment	z	x	y
Laws	y	y	z
Resp govt	w	x	y
Culture	x	z	x
PFC/Tariffs	Yes	No	No
GNP/gnw	High	Low	Low

'inconclusive'

6.3 **Method of Agreement**

	A	B
Natural endowment	High	Low
Laws	No	Yes
Resp govt	Yes	No
Culture	Awful	Wonderful
Tariffs/PFC	Yes	Yes
GNP/gnw	Hi	Hi

But effect (dependent variable) (GNP) can have more than one cause ('protection' is not the only candidate).

6.4 **Method of Concomitant Variation**

	A	B
Natural endowment	Hi	Lo
Laws	Yes	No
Resp govt	Yes	No
Culture	Wonderful	Awful
Tariffs/PFC	Yes	No
GNP/gnw	Hi	Lo

"But every attribute of the social body is influenced by innumerable causes; and such is the mutual action of the co-existing elements of society, that whatever affects any one of the more important of them, will by that alone, if it does not affect the others directly, affect them indirectly." p71

6.5 **Method of Residues**

	A
Natural endowment	Lo
Laws	No
Resp govt	No
Culture	Awful
Tariffs/PFC	Yes
GNP/gnw	Hi

"it presupposes that the causes from which part of the effect proceeded are already known; and as we have shown that these cannot have been known by specific experience ....." p72

Lecture 4.
Worksheet

1. Why does Mill argue that 'the cause of great national wealth must be complex'? Is this a valid argument?

2. What, if anything, is wrong with Hans Reichenbach's [1891-1953] frequency interpretation of probability:

In the case of a conventionally six-faced true die, the probability of throwing a six is the frequency with which the six will be thrown in the very long run.

as opposed to the alternative odds interpretation:

In the case of a conventionally six-faced true die, the probability of throwing a six is computed by giving even odds to each possible outcome, that is, one in six.

3. "Can a scientific theory be arrived at/constructed (choose your own verb at this stage) by non-scientific means?"