Some basics of philosophy and the philosophy of science

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Epistemology

Epistemological Question 1

What is knowledge?

A. Traditional normative
   (Socratic view)

   Knowledge = true, justified belief

   Belief = to have information about

   Justified = (i) inferable from axioms
               (ii) supported by evidence

   True = (i) correspondence
          (ii) coherence
          (iii) consensus
          (iv) pragmatic
B. Weaker view

Knowledge = Common belief

- Distinction normative - descriptive

1. Descriptive - what people act as if believe/say they know

2. Normative - what knowledge ideally should be like

- True, justified belief as a “regulative ideal”
Epistemological Question 2
Do we have knowledge?

• Answer depends on our definition of knowledge (classical point of departure = true, justified belief)

A. **Dogmatism:** Yes we know that we know

B. **Academic scepticism:** No, we know that we do not have knowledge
C. Pyrrhonic scepticism: We don’t
  Pyrrhon from Elis know if we
  Sextos Empiricos have
  (perhaps we
  do)

D. Fallibilism: Peirce, Popper
  - Everything we believe can be wrong
  - we must always be prepared to revise our beliefs
Epistemological Question 3

How does what is believed to be knowledge arise?

Three ideal types (Francis Bacon)
• The Spider (rationalism),
• The Ant (empiricism),
• The Bee (combinations)
A. Rationalism (Kant, Descartes)
- The spider (the net)
  • The knowledge seeking agent is active - innate knowledge
- Reason, logic, mathematics, deduction
- Intuition, analysis

B. Empiricism (Hume)
- The ant (the ant hill)
  • The knowledge seeking agent is passive
- tabula rasa (except regarding contiguity and similarly based generalization)
- observation, statistics, botany, geography, association, induction
- observation, synthesis
Example: Hume vs Kant

**Hume:** The sun rises every morning (generalization underdetermined by data) cause-effect (2 billiard balls collide) = repeated contiguity in space and time + psychological habit

**Kant:** Causality innate category (reason is active)
C. Combinations

• Empiricist - Rationalism

or

• Rationalist - Empiricism

- The Bee (Bacon himself) (honey - extracted and processed from nectar)

• The knowledge seeking agent both

  passive and active

Observation and intuition

- Abduction (Pierce) going from the particular to a general law (principle, essence)
Deduction \[ p \rightarrow q \]
(modus ponens) \[ p \]
\[ q \]

Induction \[ XXX \rightarrow \text{All crows are black} \]

Abduction \[ X \rightarrow \text{All crows are black} \]
Epistemological Question 4

Knowledge interest

A. What do we want to have knowledge of?
B. Why do we strive for knowledge?
C. In whose interest are we striving for knowledge?

Taxonomies of Knowledge interest
• Nomothetic - idiographic (Dilthey)
• Instrumental - intrinsic
• Descriptive (explanatory) - interpretative - constructive
• Nomothetic - idiographic (Dilthey)

A.1. Nomothetical knowledge -
general principles (natural
science)

2. Idiographic knowledge -
particular phenomenon
(some Humanities)

• Intrinsic - instrumental

B.1. Intrinsic value (knowledge-
per-se)

2. Instrumental (knowledge
means for other goals)
# Studying a painting

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<th>Intrinsic Knowledge -per-se</th>
<th>Instrumental knowledge as a means</th>
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<td>General principles for pictorial repr.</td>
<td>Understand general law for pictorial rep. in advertising</td>
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<tr>
<td>Idiographic</td>
<td>A picture</td>
<td>Understand the mind of the artist</td>
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• Descriptive (explanatory) - interpretative - constructive

C. 1. Depicting, descriptive and explanatory
2. Interpretative
   (Psychotherapy, lit. criticism)
3. Constructive (A1 technology)
Epistemological Question 5
How is knowledge justified?

• Normative views
  A. Authority (refer to the Bible, Aristotle)
  B. Observation + statistics (positivism + empiricism)
  C. Interpretation + intuition (hermeneutics)
  D. Conceptual analysis
  E. Deduction (from axioms)
  F. Calculation of (practical) consequences
Dogmatism - A
Empiricism - B
Rationalism - C, D, E
Pragmatism - F

Normatively basic: B - E?

The distinction
1. Normative
2. Descriptive
• Descriptive views
How is knowledge justified?

Example: Consider a claim

1) Made by a friend
2) Made by an enemy
3) Which gives fame and money
4) Which is accompanied by flattery
5) Which leads to a job

What criteria of acceptance should we (normative) use? On what grounds do we actually accept the claim (descriptive)?
Epistemological Question 6

How is new knowledge discovered?

**Distinction.**

1. **Discovery** (creativity -
   “Be positive - don’t criticize”

2. **Justification**
   “Be cautious - subject to criticism”

**Discovery**

1. Psychology of creativity: Koestler
2. Sociology of knowledge (power): Woolgar
Example

**Thomas Kuhn vs. Positivism**

**Positivism:** Science develops cumulatively through rational and empirical arguments

**Kuhn (Hegel, Fleck):** No science develops discontinuously through scientific revolutions. Other types of justification are used than those which are normatively justified

- Paradigms are created

**Positivism:** Normative view

**Kuhn:** A more descriptive view but also paradigms are idealizations
Epistemological Question 7

How should scientific knowledge be organized (normative)?
How is scientific knowledge actually organized (descriptive)?

Normative
1. Concepts (terms/vocabulary)
2. Classifying concepts - taxonomies
3. Relations between concepts (statements/claims/sentences)
4. Relations between claims (description, explanation, theory)
Concepts

Concepts can be captured and described through

- Examples
- Characterizations
- Definitions

And measured through

- Operationalizations
1. Examples

What is nature?

A. Verbal examples
   
   Forests and lakes
   Trees and flowers

B. Ostensive

Brought to attention by pointing (to a tree).
The phenomenon can be unknown

C. Typification

Find a typical representative (using some criterion).

- simple types
- prototypes
- stereotypes
- ideal types
- maximal types
Exemplifications

Examples can be more or less typical according to particular criteria

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<td>Example which has a set of properties which can be shared by more than one instance</td>
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<td><strong>2. Prototype</strong></td>
<td>Example which is central from some functional point of view</td>
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<td><strong>3. Stereotype</strong></td>
<td>Example which captures what most people believe</td>
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<td>4. Ideal type</td>
<td>Example often constructed according to certain theoretical or normative principles</td>
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<td>5. Maximal type</td>
<td>Example which in some way maximizes the properties a particular type of phenomenon can have</td>
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2. Characterizations
   (descriptions)

We can also imagine first attempts at definitions which can be called characterizations (i.e. some important properties are given)

A car is a means of transportation (also true of bikes, trains, etc)
3. Definitions

In science, concepts are traditionally identified through definitions.

A. Factual - lexicographic

1. Factual definitions
   (defining real entities)

2. Lexicographic (nominal)
   (defining words)

B. Descriptive - stipulative

Descriptive -
   trying to capture
   what is there

Stipulative -
   researcher
   (normative) decides and
   stipulates
Modes of defining

1. Most classic
   A. Genus proximum + differentia
      (closest class)   specifica
      (differenting property)

      Gen pr       Dif spec
      Man     animal    rational
      Car     vehicle   4 wheel and
                 motor powered

B. Necessary and sufficient conditions
   A sound is a phoneme \textit{iff} it is a
   smallest meaning differentiating sound unit
4. Operationalizations

A fourth important way of capturing concepts is by associating them with measuring operations.

• Heat = A numerical value as measured by a thermometer
• Intelligence = A numerical value as measured by an intelligence test
Many concepts can be identified by combining all of the methods mentioned above

1. Definition (types A & B)
2. Characterization
3. Exemplification (including typification)
4. Operationalization

It is frequently a good idea to attempt this.

The distinction normative (stipulative) - descriptive can be applied to all types of concept identification
Elementary set theory is a good instrument for investigating necessary and sufficient conditions.

Too wide definition = perhaps necessary, but not sufficient
Too narrow definition = perhaps sufficient, but not necessary

Too wide?

Nurse = def. person who cares

? Transport = def. Transference of something X from something Y to something Z

? Communication = def. Transference of something X from something Y to something Z
Too narrow?

?? **Nurse** = def. person who cares for the sick
Counter example e.g. Wet nurse

?? Communication = def. Transference of information from something Y to something Z

Counter example ?? e.g. Communication by rail
2. Taxonomies - Systems of concepts - classification

Normative requirements
1. Homogenous basis for classification
2. Mutually exclusive categories
3. Exhaustive categories
4. Simple
5. Perspicuous
6. Useful/applicable

Examples of what could be classified
- languages
- types of transport
- types of people
Two kinds of taxonomies

1) Mutually exclusive categories of occurring empirical instances

2) Mutually exclusive analytical properties (but not occurring empirical instances)
   
   1) color
   
   2) size

Example: Big red house
3. Claims, Statements (sentences)

How can the truth/correctness of a claim/statement be corroborated/supported?

Normative requirements

1. Observation (statistics)
2. Interpretation, intuition, analysis
3. Deduction from already accepted statements
4. Authority?
5. Claims about usefulness
To some extent these requirements correspond to traditional “theories of truth”

- Correspondence (1, 2)
- Coherence (2, 3)
- Consensus (4)
- Pragmatic (4?, 5)
4. Theories

Normative requirements

1. True
2. Non-contradictory
3. Exhaustive
4. Simple
5. Perspicuous
6. Useful

• To show that these criteria are met is to justify and to support the theory
Normative criteria and theories of truth

1. True --> correspondence
2. Non-contradictory--> coherence
6. Useful --> pragmatic
3, 4, & 5 less clear

Theories of truth and ontology

• **Correspondence** theory often **realism**
• **Coherence** theory often **idealism** (phenomenalism)
• **Pragmatic** theory coming close to:
  - fictionalism
  - conventionalism
  - nominalism
The purpose of a theory

A. Explanation (and description):
   (i) statistical correlation
   (ii) causal connection
   (iii) convention

Less common (Aristotle’s - teleological, material and formal causes)
B. **Understanding (1):** Finding purpose, goal, intention, function or convention (human behavior)

Understand (0) -- Explain
-- Understand (1)

C. **Usefulness:** Helps in creating useful theories, culture or technology

- **Difference of perspective/difference of degree**

Description - Explanation - Understanding - Usefulness
The organization of a theory

(i) Descriptions, explanations which meet certain normative requirements

(ii) Classical ideal (axiomatized theory)

Classical example of axiomatized theory Euclid’s Geometry (300 B.C.)

Axiomatized theory (Aristotle)

(i) Axioms: Independent basic true statements

(ii) Inference Rules: Truth preserving rules (derivational rules) for deriving new statements

(iii) Derived (true) claims (theorems)
Example of an inference rule:

Modus Ponens: \( p \rightarrow q, \)
\[ p, \]
\[ q \]
Desirable properties of an axiomatized theory

Completeness
The theory is complete (exhaustive) iff all true statements are derivable.

Decidability
The theory is decidable iff it is possible for every statement to determine whether it is derivable.

Formalization
The theory is formalized if it is formulated in a formal language (vocabulary, rules of formation) which has:

- syntax
- semantics
- pragmatics
The hypothetical deductive method

The axiomatic ideal in combination with empirical observation has resulted in

The hypothetical deductive method

Aristotle  The points of departure (the axioms) should be evidently true

Later  the points of departure can be hypotheses (guesses)

the consequences of which can be tested empirically
The hypothetical deductive method cont.

From a **theory or hypothesis** we derive consequences or testable implications.

These are tested empirically.

Sometimes one needs to add **postulates or auxiliary hypotheses** to be able to derive something testable.
Example: Semmelweiss discovery of bacteria

**Hypotheses:** we can avoid infection if we wash in an alcoholic solution

**Auxiliary** (i) Alcohol kills bacteria

**Hypotheses:** (ii) Bacteria attacks patients

**Testable**

**Implication:** If we wash in an alcoholic solution we do not infect the patients
Ad Hoc Hypotheses

Auxiliary hypotheses should have independent support. Otherwise, they are ad hoc (for this), i.e. they are invented only to save the theory.
Back to the justification of a theory

• The debate on verifiability

How can theoretical generalizations be verified?

- Crows are black

What does this claim mean/refer to?

(i) All crows right now
(ii) All crows we have observed
(iii) All crows that have existed
(iv) All crows that have existed and will exist in the future
Empiricism: The claim should refer to (i) or (ii)

Rationalism: No to (iv) or even to all possible crows i.e. The claim means crows are necessarily black

Empiricism: Perhaps the rationalist is right about what the claim means but this shows that we must be uncertain about generalizations. They cannot be verified (Hume)

Karl Popper: But they can be falsified
• As soon as we find a black crow we know the claim is false

• We should believe not (only) what we can verify but also what we can not falsify

• Since verification is impossible for generalizations and generalizations are necessary in science we should construct as strong hypotheses as possible, so that it is easier to see how they can be falsified (i.e. have information content)

• Thinking is cheap verification impossible and falsification is possible but can be expensive
But

**Quine**  How can we know when something is falsified?

+ other problems

(i) **Underdetermination** of concepts

\[ \text{rabbit}_1 + \text{rabbit}_2 + \text{rabbit}_3 \rightarrow ? \]

the concept rabbit

(ii) **Indeterminacy** of concepts (vagueness)

Gavagai:  
(i) rabbit substance  
(ii) temporal sausage rabbit  
(iii) time slice rabbit
Solutions to the problem of underdetermination

1. **Conceptual realism:** - an abstract entity outside of time and space

2. **Conceptualism:** - a psychological construct, e.g. prototype, essence or meaning potential

3. **Nominalism:** - name + relevant referents

4. **Operationalism:** (Bridgeman) e.g. Intelligence = what is measured by an intelligence test

**Criticism of operationalism:**
(i) surplus meaning - always possible to improve measuring operations
(ii) understanding the operations presupposes the concept
Ethics

Beliefs concerning how we should act towards others whilst being concerned with their wellbeing

Examples

1. The Golden rule (Jesus, Confucius)

2. The universalizability criterion of Kant “Act so that the rule for your action could become a general law”
Different views on the nature of “moral goodness”. In the expression “X is good”, X is

(i) A non-cognitive emotional expression

**Value-Nihilism** (A. Hägerström)

(ii) A certain subjective feeling, e.g. Pleasure value

**Subjectivism** (E. Westermarck)

(iii) An objective property of an entity (simple, unanalyzable)

**Value objectivism**

(G. E. Moore)
(iv) An efficient means to reach a goal

Value instrumentalism (R B Perry)

(v) A property given by conventional norm

Value conventionalism
A related issue
- What is a ”good action”?

A “good action” is

(i) an action with a good purpose

(ii) an action in accordance with an ethical norm

(iii) an action with good results
Another issue - the delimitation of a relevant norm group

The Norm group - the group the wellbeing of which we are concerned. Which group is it?

- everything
- everything living
- all animals
- all humans
- particular group of humans
- my primary group
- myself
# Ethics in science

Three general ethical considerations

(i) Not hurt (give pleasure)
(ii) Not lie (give correct information)
(iii) Not force (give freedom)

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Everything relevant everywhere to some extent XXs mark more relevant
Esthetics

Esthetics  Beauty
         Elegance
         Simplicity

In the expression “X is beautiful”,

X is

(i) A non cognitive emotional expression
(ii) A particular subjective feeling
(iii) An objective property of a phenomenon
(iv) An efficient means to reach a goal (advertising, political propaganda)
(v) A property attained by being produced according to an esthetical norm
### Schools of the philosophy of science

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<th>Rationalism</th>
<th>Normativism</th>
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<td>Scepticism (akad)</td>
<td>Empiricism</td>
<td>Descriptivism</td>
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