1. Seminar 5, Scientic methods and data ethics

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2. Introduction

The purpose of seminar 5 is give an overview, of the philosophical theories and definitions of science, and how to conduct it ethically.

3. Key Findings

3.1. What is science

Science consists of "Large amount of relatively secured knowledge", with methods developed and accepted by the scientific community. These methods follow clear and explicit rules and procedures. Replication is crucial, as methods that are arbitrary and cannot be repeated are not scientic. Science strives to be as objective as possible.

Science can be categorized accordingly:

- Nomothetic (general) studies: Aim to identify general laws or principles. Is based on what Kant described as a tendency to generalize. E.g. natural laws.
- Idiographic (specific) studies: Focus on specific objects, events, or processes and is based on what Kant described as a tendency to specify. E.g. cultural or other human aspects.
- Formal science: Involves the study of abstract systems, such as logic, mathematics, and statistics.
- Empirical science: Relies on empirical evidence gathered through experimentation or data collection.

3.2. What is knowledge

Plato's classic definition of knowledge: Knowledge is justified true belief, meaning a person knows a proposition if it meets three conditions: the proposition is true, the person believes it, and the person is justified in believing it.

Epistemology: The study of knowledge.

- Rationalism: Knowledge is gained through logic and deductive reasoning.
- Empiricism: Knowledge is acquired through empirical evidence.

3.3. What is truth

Truth can be defined according to these different theories in philosophy:

- Correspondence theory of truth: states that the truth or falsity of a statement is determined only by how it relates to the world and whether it accurately describes it.

- Coherence theory of truth: states that a statement is true if it is consistent and logically fits with other statements within a system or framework.
- Pragmatism: a statement is true if it leads to successful, practical outcomes or if its predicted consequences prove to be accurate.

3.4. Hypothetico-deductive method

The Hypothetico-deductive method was proposed by Karl Popper it focuses on formulating hypotheses that can be tested and potentially falsified. This is in contrasts with the axiomatic method, which summarizes and justifies a large number of statements by proving that they can be deduced from a small number of axioms.

According to Karl Popper, a hypothesis is a proposed explanation for a phenomenon which is Scientific, i.e. it should be falsifiable. The number of observations alone cannot confirm a hypothesis. Hypotheses are supported to varying degrees when they are not falsified. While a hypothesis may seem like the best option based on current knowledge, its truth is still uncertain.

If there are multiple hypotheses that can answer the same set of questions one should choose the simplest hypothesis(Occam's Razor) because it is more aesthetic, easier to understand. Which suggests selecting the hypothesis with the fewest assumptions if two make the same prediction. Popper's approach emphasizes boldness in forming hypotheses and strictness in rejecting them, i.e. the hypotheses should be abandoned under the circumstances you've declared.

3.5. Ethics in science

A researcher's work is governed by rules, regulations, and ethical responsibilities to ensure quality and moral acceptability. This includes adhering to explicit and implicit norms in research, such norms can be the Helsinki Declaration for human experimentation. Researchers must follow national and local laws addressing issues like discrimination, harassment, and gifts, as well as field-specific ethical codes.

Declaration of Professional Ethics: Emphasizes pursuing objectivity, clarifying roles and obligations, impartial assessment of alternatives, managing conflicts of interest, avoiding predetermined outcomes, safeguarding privileged information, demonstrating professional competence, and upholding confidence in statistics.

The Ethical Guidelines for Statistical Practice: Emphasize professional integrity, accountability, and data/methods integrity. They outline responsibilities to science, the public, funders, clients, research subjects, colleagues, other statisticians, and address handling misconduct allegations. Employers and clients also have ethical obligations when working with statistical practitioners.

In statistics and data science, careful handling of data is crucial, particularly during collection, storage, and usage for statistics and machine learning. Adherence to regulations like the European Unions General Data Protection Regulation (GDPR) is essential.

4. Conclusion

In seminar 5 gave a overview of the philosophy and ethics of Science. Science is a structured pursuit of knowledge, it relies on rigorous methods and objective reasoning. Either by deductive and empirical approaches to falsify hypothesis, but its truth is always uncertain. It is the researcher's responsibility to ensure these approaches are conducted ethically. In conclusion "Don't do bad things with data".