

# Research Methods in CSAI

[informatics.sussex.ac.uk/users/johannah/ResMeth/](http://informatics.sussex.ac.uk/users/johannah/ResMeth/)

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# Debugging Session

- Problems?
- Issues?
- Questions?
- Interest Points?
- Surprises?
- Challenges?
- Successes?

“A DPhil thesis must make a substantial original contribution to knowledge or understanding”

# Knowledge

- Many competing theories of knowledge
- Plato defined knowledge as: “Justified true belief.” In order for it to be knowledge *at least* these three must be true
- What do we mean when we say we ‘know’ something?
- ‘Knowing that’ vs ‘knowing how’
- *a priori* and *a posteriori* knowledge

# Knowing

- What is our epistemology? (theory of knowledge)
- Three main theories of knowledge acquisition:
  - Empiricism
  - Rationalism
  - Constructivism

# Positivism and Constructivism

- Positivism
  - Objective knowledge comes from, and only from, our senses
  - Objective and deterministic
  - Presumes predictability and control
- Constructivism
  - Our knowledge is constructed: it comes from convention, perception and our social context
  - Subjective rather than objective ‘truth’
  - Social enterprise

# Science

- Natural science, social science, formal science
- How do we distinguish science from non-science?
- Popper: science should aim to produce falsifiable claims (i.e. claims that could, in principle, be proven false)
- What are the aims of science?

# The Scientific Method

- Prescriptive approach
- Goal is to explain the world in a reproducible way from observation or experimentation
- Cf. positivism: “every rationally justifiable assertion can be scientifically verified or is capable of logical or mathematical proof.”
- Five major underlying assumptions (Cohen & Manion 1994):
  - Order
  - External Reality
  - Reliability
  - Parsimony
  - Generality

# Scientific Revolutions

- *The Structure of Scientific Revolutions* by Thomas Kuhn (1962)
- Science does not progress via a steady building of new knowledge, but undergoes periodic conceptual revolutions, often called *paradigm shifts*
- Three stages:
  - Prescience
  - Normal science
  - Crisis and new paradigm

# Questioning the Scientific Method

- Can the methods of natural science really be extended to other fields?
- Do phenomena exist 'out there' or are they just interpretations?
- Can the world be understood objectively? Is objectivity really possible? Is objectivity really necessary?
- Can quantitative measurement capture the meaning of social behaviour? Missing our experience.
- Don't the researchers have an effect on the data found? Is data affected by cultural understanding? Our expectations? Our beliefs and desires?
- How many correlations is enough?

# Empirical Science

- Five steps in the process (Mouly, 1978)
  - Experience
  - Classification
  - Quantification
  - Discovery of relationships
  - Approximation to the truth

# Is Computer Science a Science?

- Is Computer Science a science or an art?
- Are you doing Computer Science? Is there a distinction between Informatics and Computer Science?
- Should we be using the Scientific Method?

# Research Data

- How will you gather data?
- How will you analyse data?
- These are two distinct but associated considerations.
- Your underlying philosophy will impact on your choices.
- There is no single 'best' way.

# Kinds of Research

- Descriptive – Capturing and describing a phenomenon
- Exploratory – Asking ‘what?’ and ‘why?’
- Predictive - Asking ‘what if?’
- Explanatory – Asking ‘why?’
- Action – Asking ‘what if?’ and applying in practice

# Qualitative vs. Quantitative

- Quantitative
  - Tends to use positivist world view
  - Data gathering of ‘facts’
  - Data tends to be numerical
  - Reliable and generalisable
- Qualitative
  - Tends to be constructivist in outlook
  - Data gathering of ‘experience’
  - Data tends to be words, pictures, objects
  - Rich and Precise

# Examples

- Quantitative data gathering methods include:
  - Questionnaires
  - Experimentation etc
- Qualitative data gathering methods include:
  - Interviews
  - Focus Groups
  - Participant Observation
  - Case studies etc
- Mixed methods include both

# Next Week

- Tasks:
  - Find two conferences, two journals, and a mailing list relevant to your research area. Bring information on these with you to class.
  - Find an example paper from your interest area. Bring a copy with you for class discussion.
- Required Reading:
  - Alan Bundy's Guide to 'How to Write an Informatics Paper':  
<http://homepages.inf.ed.ac.uk/bundy/how-tos/writingGuide.html>