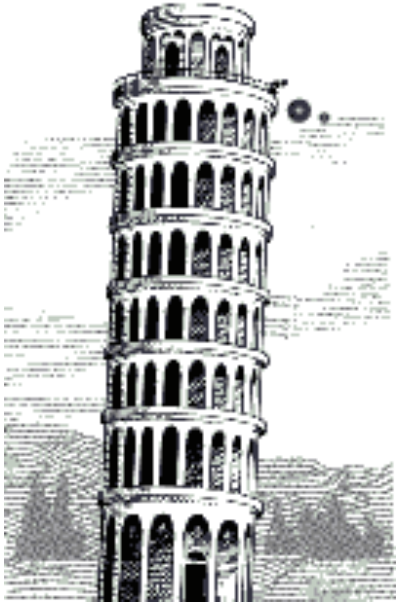


Research Methods

Research Seminar

In-Class Presentation I: Research Question

- Until Wednesday
- Identify the research question for your master thesis
- Use Miro Template

Validity

What Makes a Good Research Design?

- Internal validity (within study)
  - Confidence in conclusions
  - Deduction: are there alternative explanations for the observed results?

- External validity (from study to the real world)
  - Generalizability to other situations
  - Induction: is the relationship generally true?

Internal Validity

- Confounding variables:
  - Are there other variables that could explain the observed results?
  - Errors of deduction:
    - e.g. concluding that A causes B when B is caused by a third (confounding) variable C

External Validity

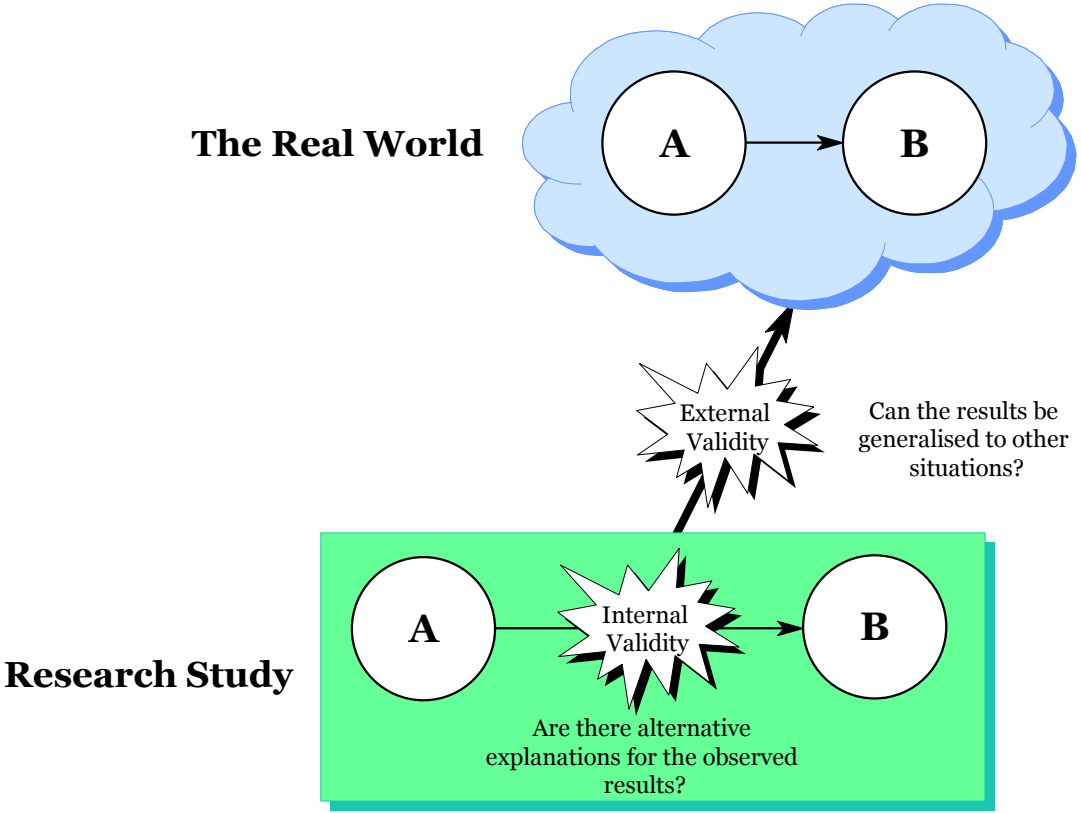
- Important measure of the practical value of results:
  - TAM: acceptance of information systems where use is voluntary
  - Error of induction: concluding that a relationship is generally true when it applies only in a particular context

- External validity determined by representativeness of context and participants:
  - Similarity between sample and target (when, where, who, how, system, why?)
  - Can only generalize to similar situations and populations

External Validity

“Most social scientific laboratory experiments are conducted with **college undergraduates as subjects**.
Typically, the experimenter asks subjects enrolled in his or her classes to participate in experiments or advertises for subjects in a college newspaper.
In relation to generalizability, this represents a potential defect in social scientific research.
Simply put, **undergraduate students are not typical of the public** at large.”
(Babbie, 1998)

Internal vs External Validity



Internal vs External Validity

- Different research methods have different strengths and weaknesses with respect to internal and external validity
  - Methods with high internal validity often have low external validity and vice versa
  - Another reason why multiple methods are often the best solution…

Research Methods

A wide range of different research methods can be used in IS research

- No “one best way” to conduct research in all situations
- Each research method has its own strengths and weaknesses
- Each suited to some types of research questions more than others

Research Method Selection

Even though each research method has its distinctive characteristics, there are large areas of overlap between them. The goal is to avoid gross misfits – that is, to use one research method when another would be clearly more advantageous

Robert K. Yin

Multi-method or mixed-method research

- Methods are not mutually exclusive:
- Each method has its own advantages and disadvantages: complementary
- A combination of methods results in a more comprehensive and convincing answer to the research question
- Triangulation of method

What is a Research Method?

- Research methods are data collection methods
- Define different ways of collecting data to test your theoretical model

- Examples:
  - Experiment:
    - apply experimental treatment(s) and observe results
  - Survey:
    - send questionnaires to people and analyze their responses

What is a Research Method?

- Each research method is really an umbrella term for a family of research methods:
  - Experiment:
    - Laboratory, field experiment
    - True, quasi, pre-experimental designs
    - Unblinded, blinded, double-blinded
  - Surveys:
    - Face to face,
    - telephone,
    - mail,
    - web,
    - email

Research Methods

Major differences between research methods:

- Type of data collected (qualitative vs quantitative)
- Role of researcher (passive observer vs interventionist)
- Setting of study (natural/field vs artificial/laboratory)

The Research Methods Toolkit

Method	Setting	Data Type	Role
Action research	Field	Qualitative	Active
Case study	Field	Qualitative	Passive
Experiment	Laboratory	Quantitative	Active
Non-reactive	Laboratory	Quantitative	Passive
Survey	Field	Quantitative	Passive

Quantitative Research

- Collect data in the form of numbers: “hard” data
- Use statistical techniques to identify patterns and relationships in the data
- Emphasizes objectivity, measurement and hypothesis testing (significance levels, effect size)

Qualitative Research

- Collect data in the form of words, sounds and images:
  - “soft” data (observations, interviews and documents)
- Analysis more subjective:
  - relies on researcher’s knowledge and experience to identify patterns and draw conclusions
- Alternative interpretations of data

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Field vs Laboratory Research

- Field research:
  - Natural setting
  - High external validity, low internal validity

- Laboratory research:
  - Artificial setting
  - High internal validity, low external validity

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Experiment

- The “strongest” research method
- The core technique of the scientific method:
  - Galileo, Newton, Pavlov
- Also used in practice:
  - Clinical trials

Experiment

- Investigates effect of an independent (manipulated) variable on a dependent (outcome) variable:
  - Independent variable called experimental treatment
  - Control group = no treatment
  - Mostly laboratory settings in IS
  - Primarily quantitative

Experiment

- Internal validity:
  - Only research method which allows causal relationships to be established with any certainty
  - All other variables controlled (participant characteristics, setting etc.)

- External validity:
  - Artificial settings and populations

Experiment: Strengths and Weaknesses

- Can only address a small no. of variables
- Unethical or impractical in many real world situations
- Questions about generalizability of results of laboratory experiments to IS practice
- Field experiments difficult to conduct in an IS context

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Survey

- Collection of data from a large number of people using a standard set of questions:
  - Mail
  - Telephone
  - Interviews
  - Electronic (email, web-based surveys)

- Mostly quantitative but may include also some qualitative data (open questions)

Survey

- Also widely used (or abused) in practice:
  - Election forecasting
  - Market research
  - TV ratings

Survey

- Internal validity
  - Questionnaire bias (wording of questions)
  - Accuracy of self-reported data:
    - memory, truthfulness, actual vs espoused behavior
- External validity:
  - Sample characteristics (sampling bias)
  - Response rates (non-response bias)

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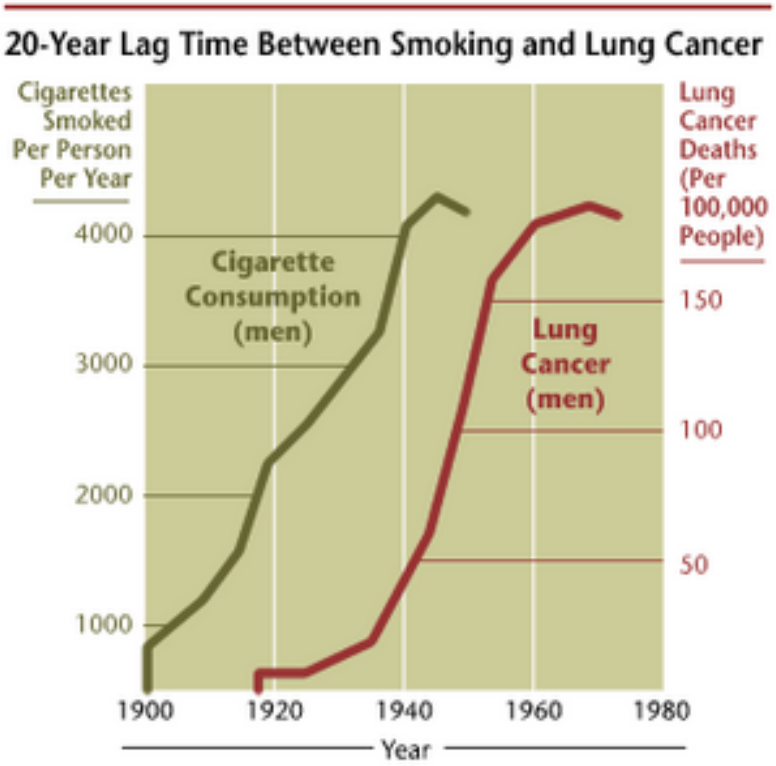
Non-reactive Methods

- Unobtrusive approaches
- Observation
  - e.g. analysis of email usage,
  - driving behavior
- Content analysis (public documents):
  - web site content,
  - research papers
- Existing statistics (public data):
  - accident statistics,
  - health statistics,
  - census data

Non-reactive methods



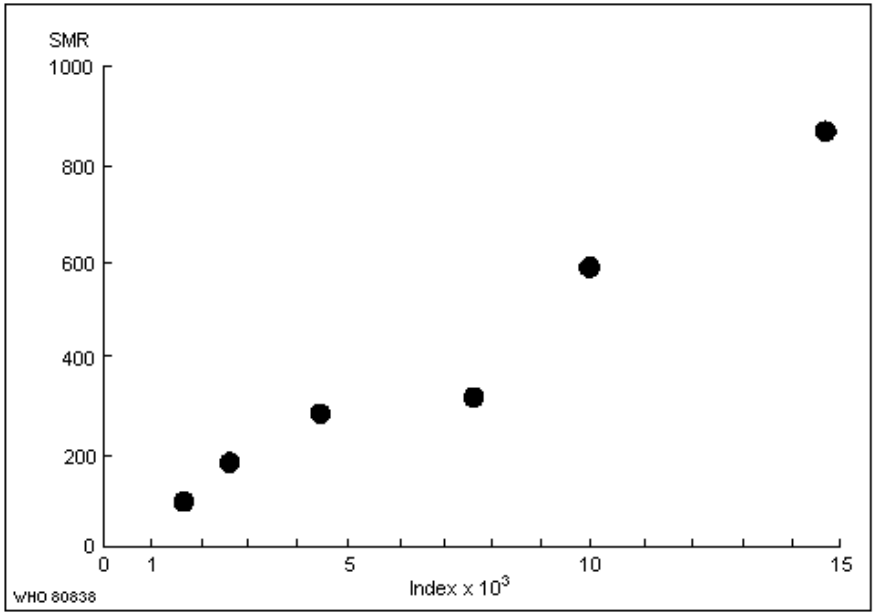


Fig. 10. Standardized mortality ratio (SMR) for respiratory cancer deaths in relation to arsenic exposure index among 527 males retired from a US copper smelter. It should be noted that normal SMR is 100 and that the arsenic exposure index for normal arsenic concentration in urine (50 µg/litre; Pinto et al., 1976) and a working period of 25 years is 1250 (Modified from: Pinto et al., 1977).

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Case Study

- In-depth analysis of a phenomenon in a natural setting:
  - Variety of data gathering techniques
  - Mostly qualitative data
  - Particularly useful for description and explanation (“how” and “why”) and exploratory research (theory building)
- Also used in practice:
  - Case studies of business successes and failures
  - Investigative journalism
  - Criminal investigations
  - Air crash investigations

Case Study

- Internal validity:
  - Subjectivity of analysis (biases)
  - Many alternative explanations of results (lack of control)

- External validity:
  - Natural setting
  - Difficult to generalize from a single case

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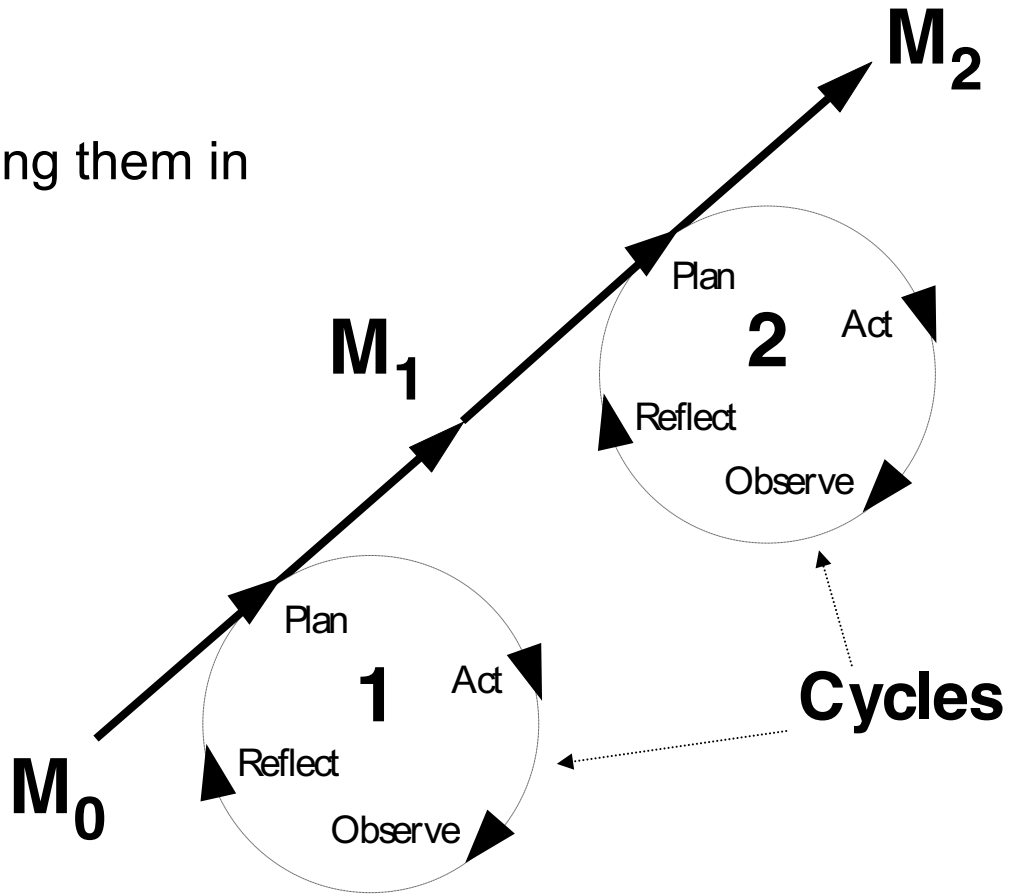
Action Research

- Way of testing ideas by applying them in practice:
  - Iterative learning approach
  - Collaboration between research and practice



Action Research

- Cross between an experiment and a case study:
  - Researcher introduces a change into a real world setting, observes the results, and uses this to improve the intervention
  - Active role (change agent)

- Objective is to achieve
  - practical results (action outcomes) as well as
  - create new knowledge (research outcomes)

Strengths and Weaknesses of Action Research

- Similar weaknesses to case study

- Internal validity:
  - Mainly relies on qualitative data (perceptions of stakeholders)
  - Even harder for researcher to be objective as an active participant

- External validity:
  - single case

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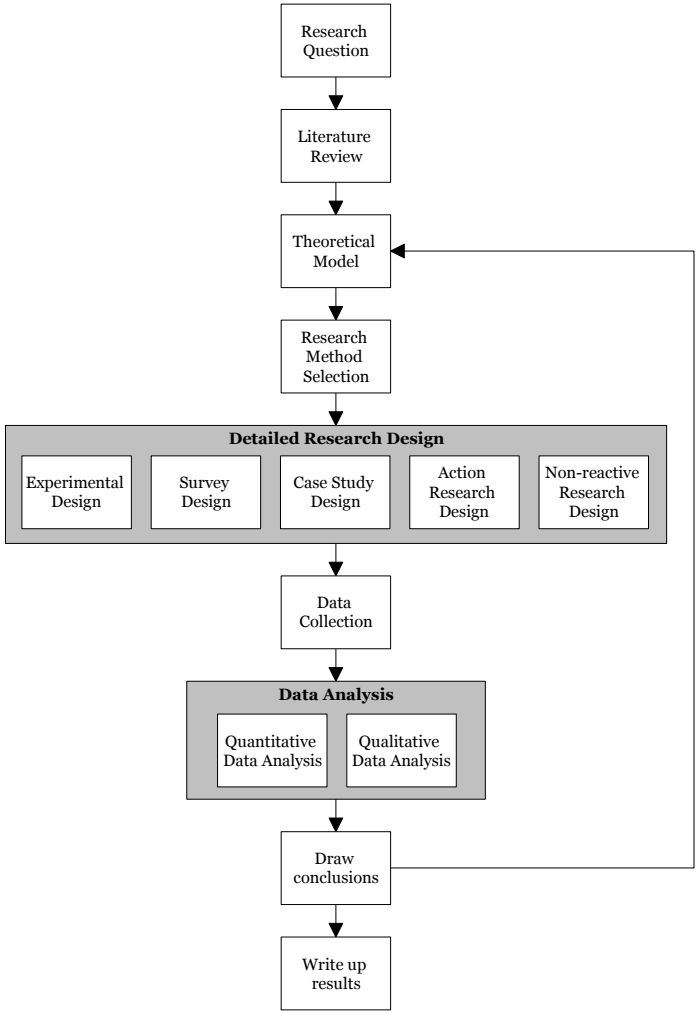
Common Elements of all Research Methods

- Need to start with some theory (however primitive)
- Theory needs to be operationalized (so it is empirically testable): quantitative measures, qualitative measures or both
- Sampling: who (or where) to collect data from
- Data analysis: need to analyze data to confirm, refine or extend theoretical model
  - Different data types require different analysis methods
- Internal and external validity: universal quality criteria that apply to all research methods


Research Question
Literature Review
Theoretical Model
Research Method Selection
Detailed Research Design
Experimental Design
Survey Design
Case Study Design
Action Research Design
Non-reactive Research Design
Data Collection
Data Analysis
Quantitative Data Analysis
Qualitative Data Analysis
Draw conclusions
Write up results

Exercises

- Identify what research methods you would use to answer the following research questions and justify your selection

1. Are waxed skis better than waxless skis?
2. Who are the worst drinkers from the European countries?

Homework

- IT-related research questions:
  - Three academic questions
  - Three practical questions

- Define:
  - Research question
  - Research method(s)