Desiging RE Research

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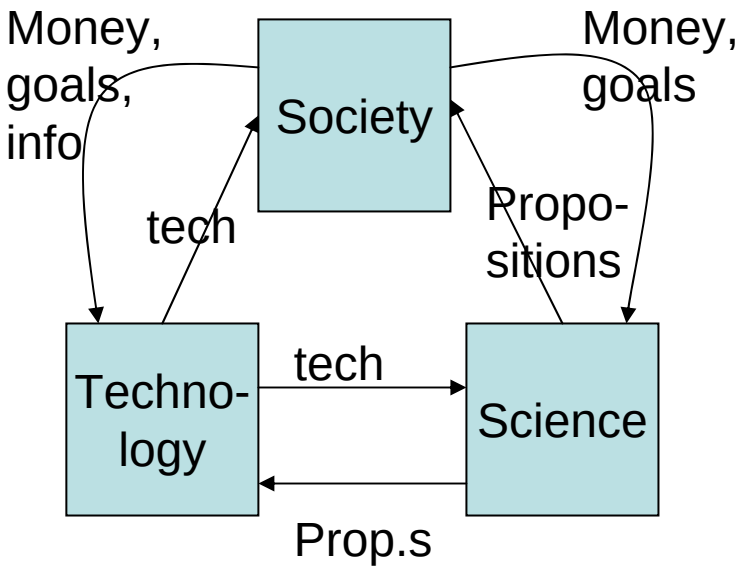
Outline

- Science-Technology Interaction
  - STS triangle
  - ST interaction is not linear
- Research methods
  - Research in the engineering cycle
  - Designing your own research method

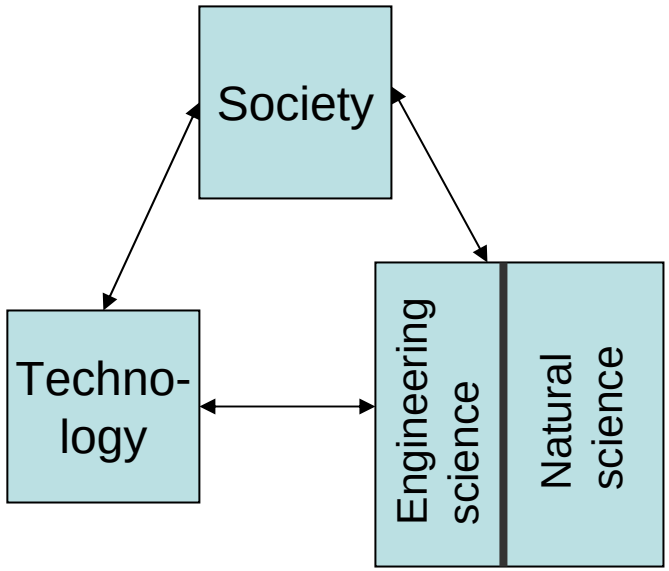
The STS triangle



- Human activity systems
- Knowledge systems
- Value systems

- RE06 technology papers
  - Technique to extract NFRs from documents
  - Technique to detect potential ambiguity
- RE06 research papers
  - Evaluation of mobile RE tool
  - Aggregation of knowledge of elicitation techniques

ST interaction is not linear



- Engineering science studies technology critically
- Natural science studies nature critically

Figuring out every way in which results can be wrong

- 15th century transfer of math & measurement from commerce to science
- 16th century transfer of instruments to science & commerce
  - clocks, navigation technology
  - Telescopes
- 17th-18th century transfer of critical tech to science
  - Thermometers, barometers
- 19th century scientific study of why/how tech worked
  - steam machines
  - locomotives
- 19th cent. transfer of tech from lab to other domain
  - Telegraph
  - Wireless
- 20th century too
- Linear model is political fiction

Engineering technology & engineering science

- Technology is not the application of science
- Engineering technology is the application of the scientific (critical) attitude
  - Contrast with craft technology
- Engineering science may yield
  - understanding of mechanisms
  - performance limits
  - definition of measures
  - similarity results (between model and subject)

Engineering design
Production engineering
Product engin eering
Maintenance engineering
...

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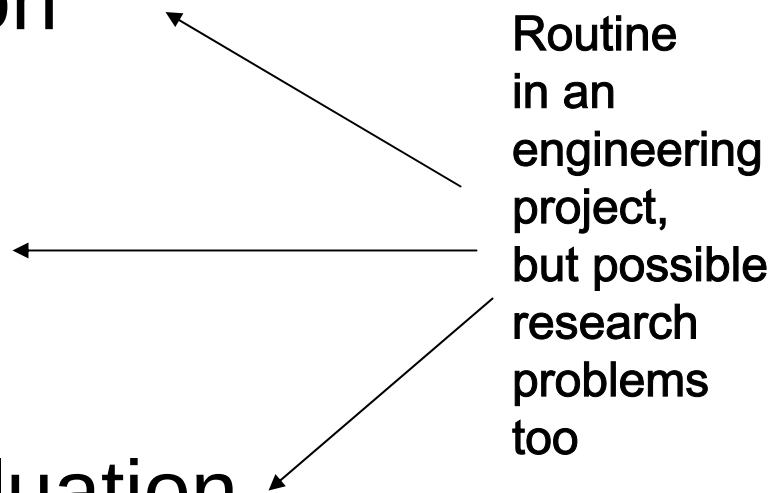
Engineering cycle

- Problem investigation
- Solution design
- Solution validation
- Implementation
- Implementation evaluation



•Research may start from problem or solution
•Always curiosity-driven
•(Only sponsors are utility-driven)

Engineering cycle

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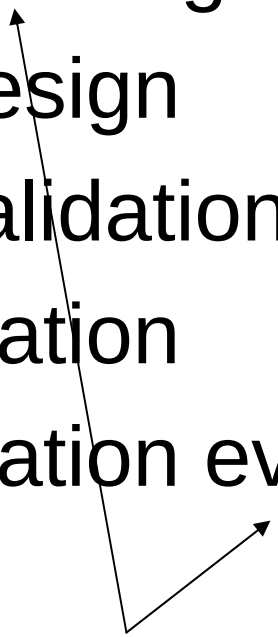

•Solution properties
•Internal validity (S & E realize G)
•Cost/benefit (trade-off)
•External validity (sensitivity)

•Desciption (what is the case)
•Evaluation (how does this compare with goals)
•Diagnosis (explain in terms of causal mechanisms)

Engineering cycle

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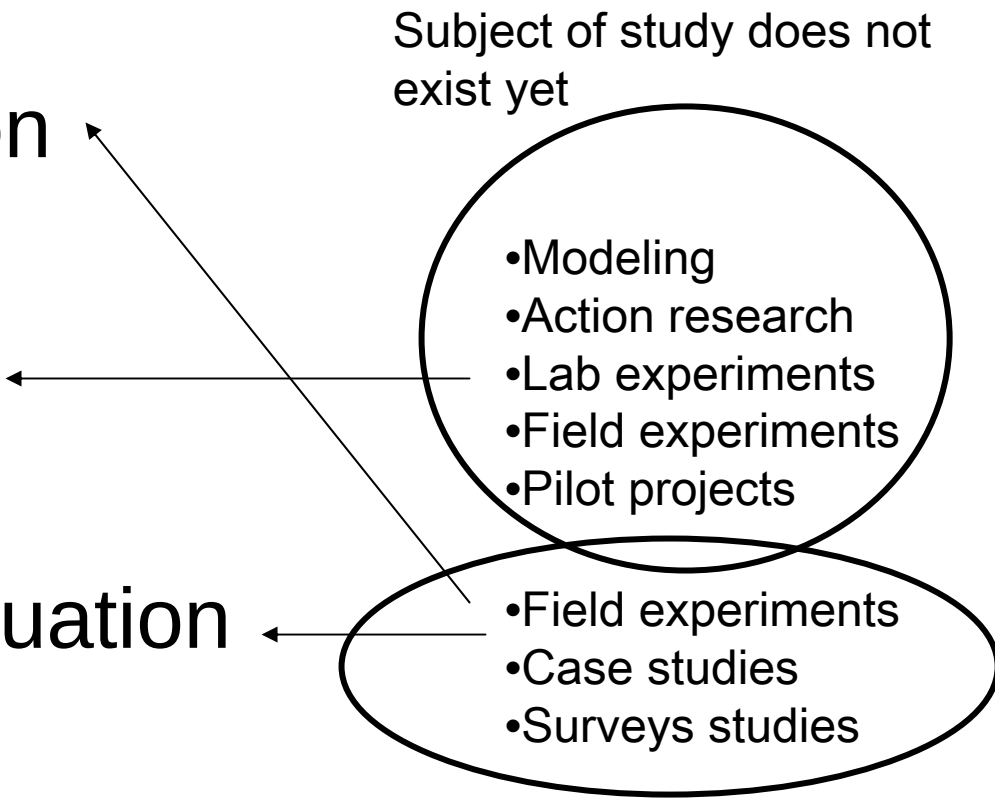
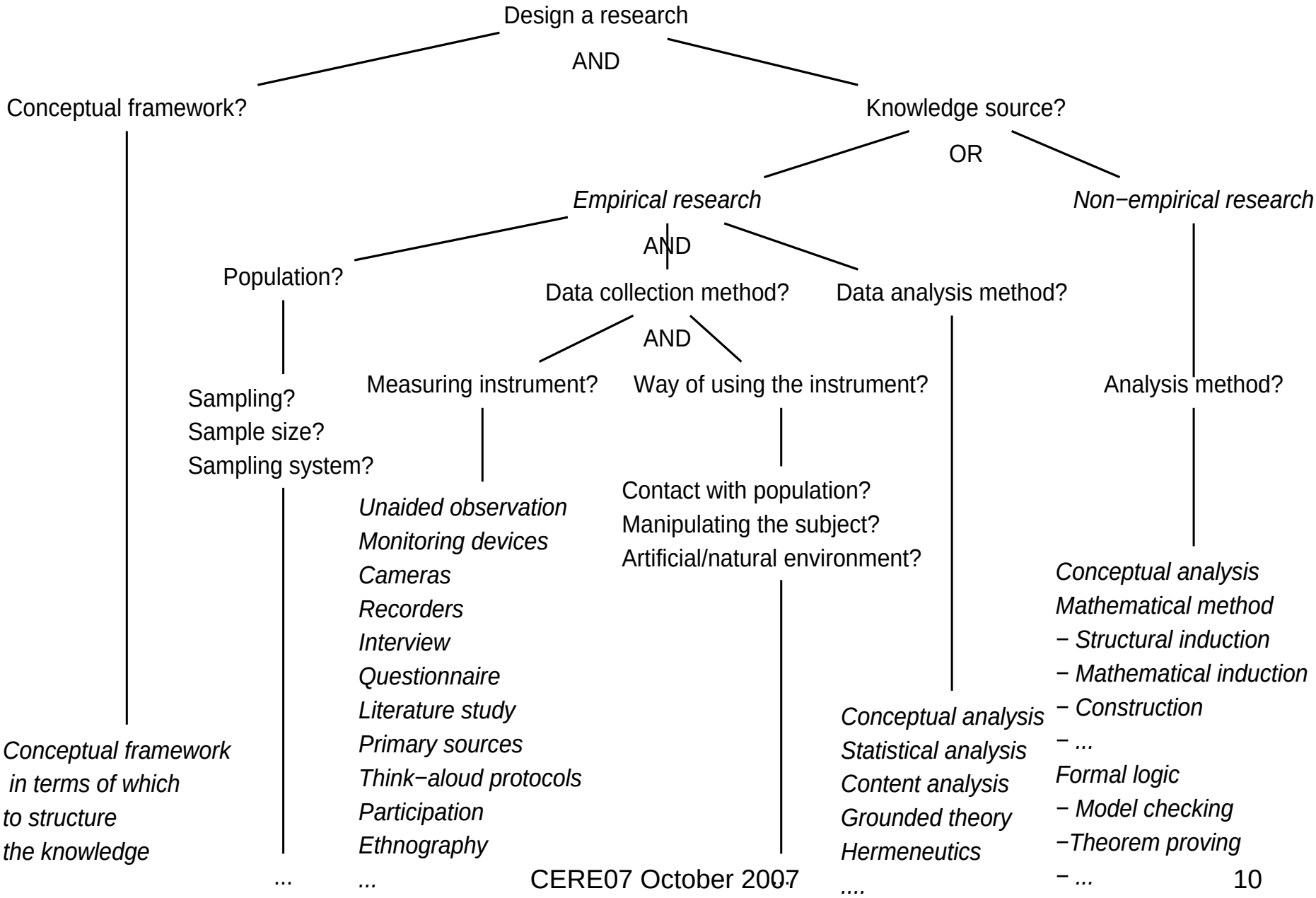


•Engineering researchers cannot ignore conditions of practice
•Need context-rich studies to make knowledge usable

Research design



Some well-known research methods

	Population	Instrument	Artificial environment	Manipulation	Data analysis method
Laboratory experiment	Relevant sample	No real-life data	Yes	Yes	Any
Simulation	Model	No real-life data	Yes	Yes	Any
Field experiment	Relevant sample	No partici-pation	No	Yes	Any
Field study	Relevant sample	No partici-pation	No	No	Any
Case study	Small	No partici-pation	No	No	Any
Action research	1	Any	No	Yes	Any

Take home message

- Separate technology from science
- Don’t ignore conditions of practice

Otto & Anton
Addressing legal requirements in RE

- Problem: using legal text as source of reqs is challenging
- Solution proposal: summary of techniques to analyze legal texts proposed in last 50 years
- Metadesign (aggregation of solutions)
- Knowledge question:
- What properties, how effective in which contexts, trade-off & sensitivity

Kauppinen, Savolainen, Mannisto RE as driver for innovations

- Research question: How does innovation work. 6 Finnish companies studied (case studies)
- Observed improvement opportunities: identification of hidden customer needs etc.
- Recommendation: develop RE techniques to do this (design goal)

Glinz
On non-functional requirements

- Analysis of NFR definitions and classificatitons
- Proposal of new definition and classification
- Taxonomic research (revising the dictionary)

Maiden, Ncube, etc. Exploring scenario forms and ways of use to discover requirements on airports that minimize enironmental impact

- Action research: Intervention using some tools, predceded by research questionds and followed by reflection.
- NB research questions are existence questions: Can tool X lead to discovery of requirements that are not discovered (in this intervention) by tool Y?

Aranda, Easterbrook, Wilson Requirements in the wild: How small companies do it

- Exploratory case study of seven small companies
- Recommendations:
  - Techniques work in a context; state the context
  - ...

Maiden Lockerbie Randall etc. Using satisfaction arguments to enhance i* modelling of an air traffic mgmt system

- Problem: inadequate semantics of links in i*; no support for impact of new SW on wider sociotechnical system
- Solution: Integration of satisfaction arguments in i*. Definition of new impact analysis procedures

Yu, Niu, etc.
Tracing and validating goal aspects

- Solution:Framework to trace aspects from GORE to programming and techniques to check system against goal model with and without aspects
- Example.

Damian, Marczak, Kwan
Collaboration mpatterns and the impact of ndistance on awareness in requirements-centered social networks

- Research question: How do distributed teams manage requirements?
- Answer: Case study of collaboration &U awareness in an industrial distributed software team, using social network theory

Kamata, Tamai
How does requirements quality relate to project succss or failure?

- Research question (see title)
- Answer: investigation of 32 projects in a company (case study)

Ho, Williams, Anton Improving performance requirementsm specification from field failure reports

- Problem: Info from field failure reports not used
- Solution proposal: procedure for using field failure reports to specify requirements on next version
- Application by authors (action research)
- Reflection: It worked when we used it

Kartseva, Gordijn Value-based design of networked enterprises using e3control patterns

- Problem: how to specify networked business models resilient to fraudulent partners
- Solution: Inventory of control patterns
- Illustration by application (by authors) on a business network

Doerr, Hartkopf, etc. Built-in nuser satisfaction– feature appraisal and prioritization with AMUSE

- Problem: Important to be sure about user satisfaction with a product early in product development
- Soltion: Technique to prioritize product features according to expected satisfaction
- Validation: Pilot project & lessons learned

Wegmann, Julia etc. Early requirements and business-IT alignment with SEAM for business

- Problem: early requirements should be aligned with business goals
- Solution: method for analyzing compotitive positiion and producing requirements

IS research problem (Department of management science)

- 1980s
  - Complaints about lack of empirical rigour
  - Papers about empirical methods for IS research
- 1990s
  - Empirical papers
- 2000s
  - Complaint about lack of relevance
  - Attempt to include design in IS research

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ICIS 1997:

Successful IS innovation: the contingent contributions of innovation characteristics and implementation process

The effects of task interruption and information presentation on individual decision making

The impact of CASE on IS professionals' work and motivation to use CASE

The impact of information technology on coordination costs: implications for firm productivity

SE ``research'' problems (Department of computer science)

- 1990s
  - Complaints about lack of validation
  - Papers about how to do experimental and case study research
- 2000s
  - Increasing number of papers validate their solution
  - Complaints about transfer of solutions to practice

ICSE 2003:

Improving web application testing with user session data

Constructing test suites for interaction testing

Improving test suites via operational abstraction

Recovering documentation-to-source-code traceability links using latent semantic indexing

Computer-assisted assume/guarantee reasoning with VeriSoft

``How to do X, or how to do it better''