Case study research or anecdotal evidence?

Data analysis and interpretation

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Analysis

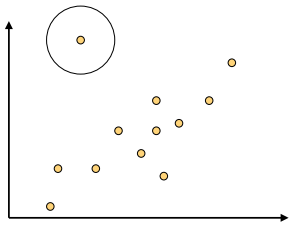
Contents

- Qualitative and quantitative
  - Data filtering
  - Analysis
- Data interpretation and validation in conjunction with the organization

Analysis

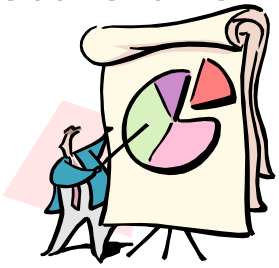
Data filtering

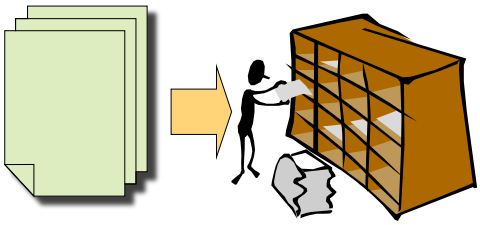
- Quantitative
- Qualitative



Analysis

Qualitative filtering/distorsions





Analysis

Qualitative analysis

- **Bring structure to the data**
  - Start by transcribing speech
  - Find key words, either from the material or from theory
  - Group and contrast statements
  - Draw conclusions

- Coding
- Data reduction
- Data display
- Conclusion drawing

[Robson02 p476]

Analysis

Data analysis techniques

[Runeson p68-69]

- **Pattern matching**
- **Explanation building**
- **Time-series analysis**
- **Logic models**
- **Cross-case synthesis**

Analysis

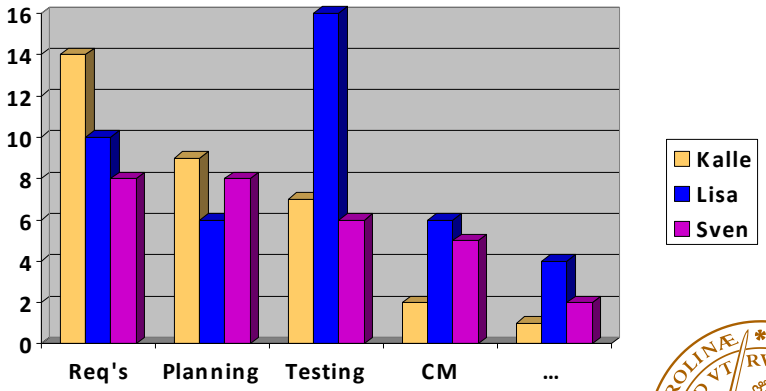
Levels of formalisms

[Runeson p64]

- **Quasi-statistical –** count occurrence and frequency of terms
- **Template based –** group statements to key words from theory
- **Editing –** create categories from the data itself
- **”Digging around” –** play with the data and draw conclusions

Analysis

Quasi-statistical analysis



Analysis

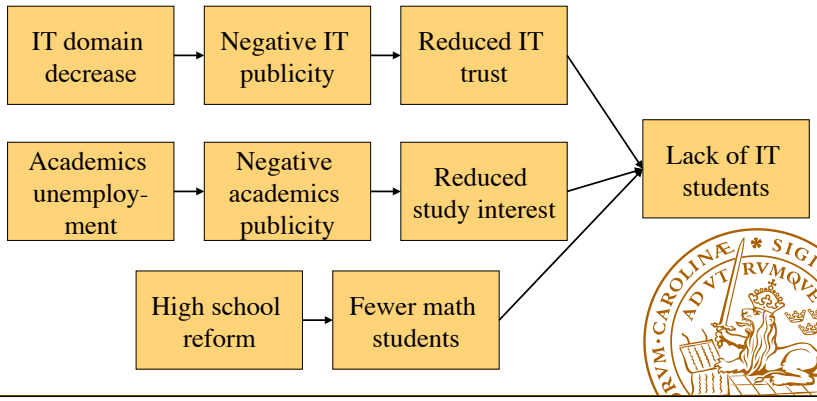
Example “fyrfältare”

	Positive	Negative
Manager	ID1, ID3, ID4	
Engineer	ID6	ID2, ID5, ID7, ID8

Analysis

Time series analysis

- Linking temporal relations between events



Analysis

Pattern matching – Protocol analysis

- Mapping empirical data to a model
- Example:
  - Program comprehension [von Mayrhauser96]
  - Software design [Owen06]

Analysis

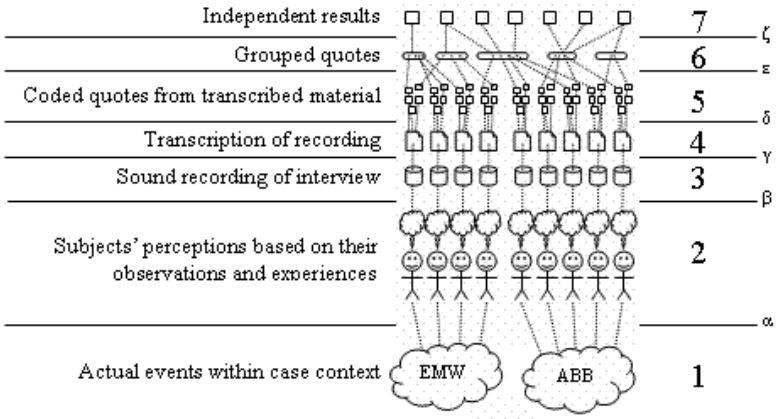
Observability in qualitative analysis

How can I trust a qualitative analysis?

- Quantitative – appropriate methods, fulfilled assumptions, significance
- Qualitative – reported methods, clear viewpoints, traceable conclusions

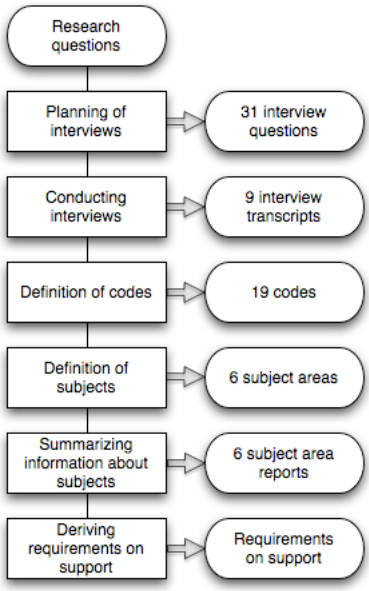
Analysis

Traceability



Analysis

Example process



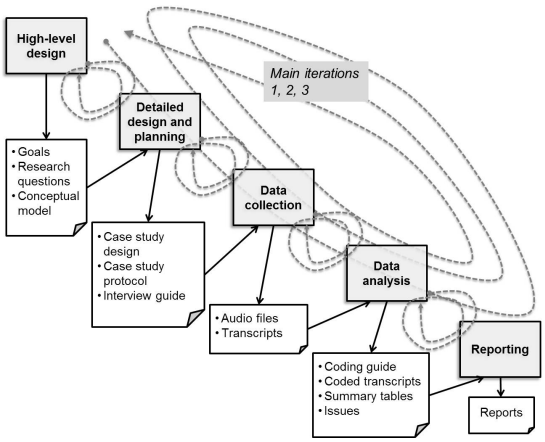
[Höst et al 2010]

Task

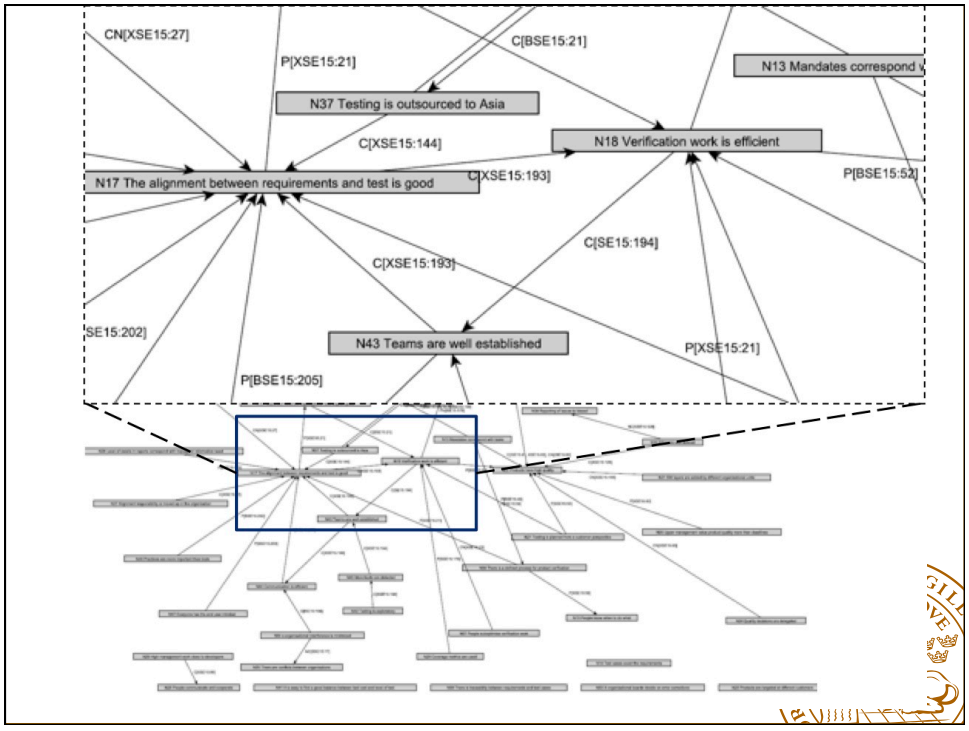
- For chapters 10, 11, 12, 14
  1. Team up with one who read the same chapter
  2. List the data sources used
  3. Assess the methods for data collection, based on checklist A.2
  4. Assess the analysis, based on checklist A.3
  5. Present and lead discussion in class

Example analysis

[Runeson ch 14]



Text	High and Medium Level Coding				Comments: Low Level Coding
	High Level	Medium Level			
	Research Question (1-3)	Group I (cat. 1-13)		Group 2 (cat. A-D)	
		Primary	Secondary		
A: Yes we tried to have testers in the requirements reviews, so they are there to kind of see, is this requirement testable?	B – experienced and expected Benefits	PQ – product quality aspects			Current alignment practice: Testers participating in requirements review
A. Variability should be more explicit on a detailed requirements level. A lot of times you have to be very explicit about the things which should be able to vary or not. Traditionally, it has been an area of concern as well. But it should be explicit in detailed requirements.	P - Problems, challenges	RQ - Requirements		PL - Product lines engineering	Variability is not explicitly defined



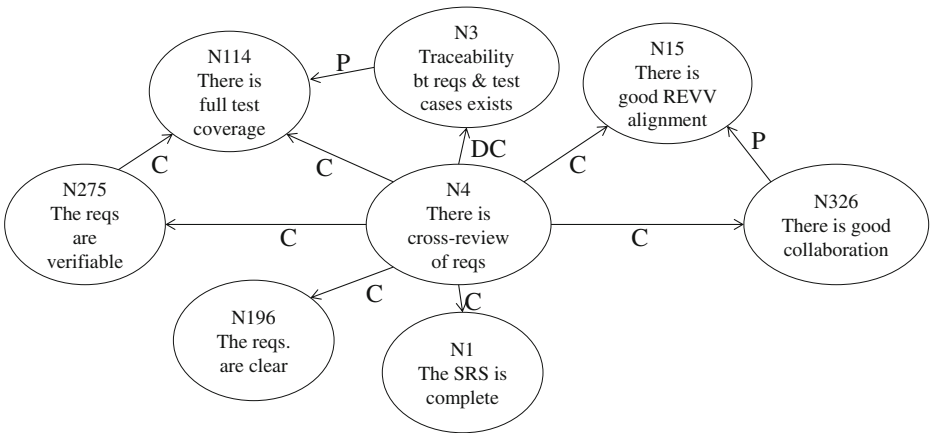


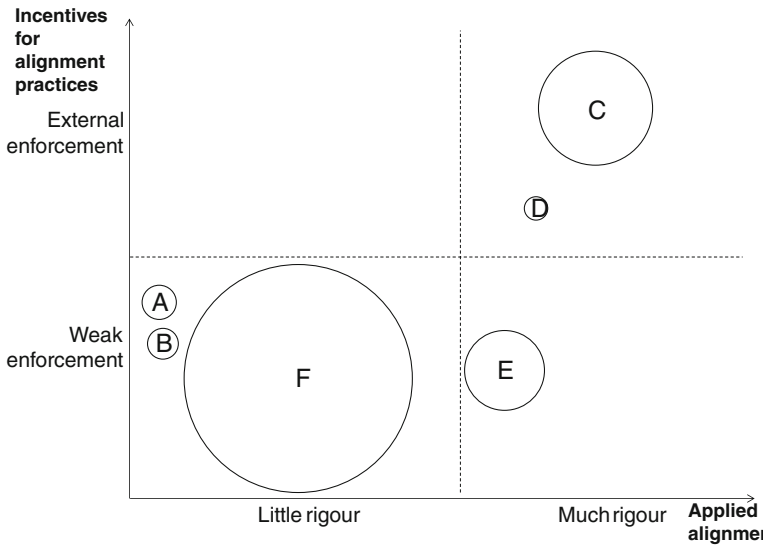
Fig. 3 Part of the abstraction representing the interpretation of the interviewee data. The relationships shown denote C - contribute to, P - prerequisite for, and DC – does not contribute to

Table 3 Alignment challenges mentioned for each company. Note: a blank cell means that the challenge was not mentioned during the interviews, not that it is not experienced

	Id	Challenge	Company					
			A	B	C	D	E	F
	Ch1	Aligning goals and perspectives within an organisation	X	X	X		X	X
	Ch2	Cooperating successfully	X		X	X	X	X
Req spec quality	Ch3.1	Defining clear and verifiable requirements			X	X	X	X
	Ch3.2	Defining complete requirements		X		X	X	X
	Ch3.3	Keeping requirements documents updated						X
VV quality	Ch4.1	Full test coverage	X	X	X	X		X
	Ch4.2	Defining a good verification process						X
	Ch4.3	Verifying quality requirements		X		X		X
	Ch5	Maintaining alignment when requirements change	X		X			X
Req's abstract levels	Ch6.1	Defining requirements at abstraction level well matched to test cases				X		X
	Ch6.2	Coordinating requirements at different abstraction levels	X					X
Traceability	Ch7.1	Tracing between requirements and test cases	X	X	X	X		X
	Ch7.2	Tracing between requirements abstraction levels		X	X	X		
	Ch8	Time and resource availability			X		X	X
	Ch9	Managing a large document space			X	X		X
	Ch10	Outsourcing of components or testing				X		X

Table 5 Tool usage for requirements and test cases, and for tracing between them. For company F the tool set-up prior to the major process change are also given (marked with 'previous')

	Requirements tool	Tracing tool	Testing tool
Requirements	C, D, E, F (previous)		F
Traces	C	D, E, F (previous)	F
Test cases	C		A, D, E, F (current and previous)



Analysis

Quantitative analysis

- Purpose:
  - Explore phenomena
  - Test hypotheses
- Toolbox
  - Graphical methods
  - Statistical methods
- Note!!!
  - Most quantitative analysis assumes random sampling

Analysis

About statistics

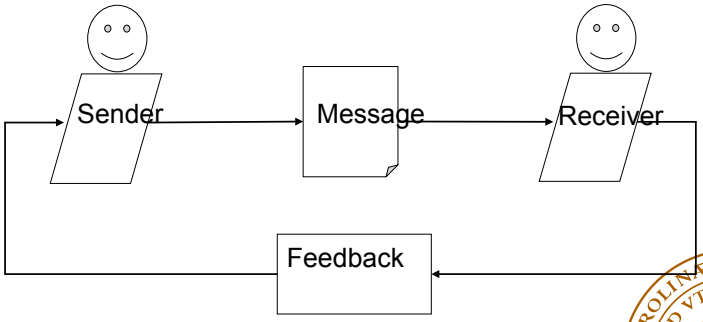
Nothing is wrong per se in applying any statistical operation to measurements of given scale, but what may be wrong, depending on what is said about the results of these applications, is that the statement about them will not be empirically meaningful or else that it is not scientifically significant. (p. 100)

Adams, Fagot, & Robinson. (1965). A theory of appropriate statistics. Pm, B(2): 99-127.

Analysis

Result validation

Validate data – not conclusions



Analysis

Result validation

- Audit trail
- Feedback
- Peer debriefing
- Triangulation
- Prolonged involvement

Analysis

Qualitative vs Quantitative

- Closer to the phenomenon
- Richer in terms of expression power
- Easy to measure
- Easy to analyze
- More exact

Analysis

Yin's advice for analysis (p137)

1. Attend all the evidence
2. Address all major rival explanations
3. Address the most significant aspect
4. Use your own prior expert knowledge

Analysis

Validity

- **Construct**
  Are we measuring/observing the right thing?
- **Internal**
  Is the study conducted well?
- **External**
  Is the setting representative?
- **Conclusion/reliability**
  Are the statistics/analyses used correctly?

Task

For each of the study types, survey, case study and experiment, place them on the scale high-to-low for:

- **Construct validity**
- **Internal validity**
- **External validity**
- **Reliability**

Analysis

Construct Validity

Low — High

Survey

Case study

Experiment

Analysis

Internal Validity

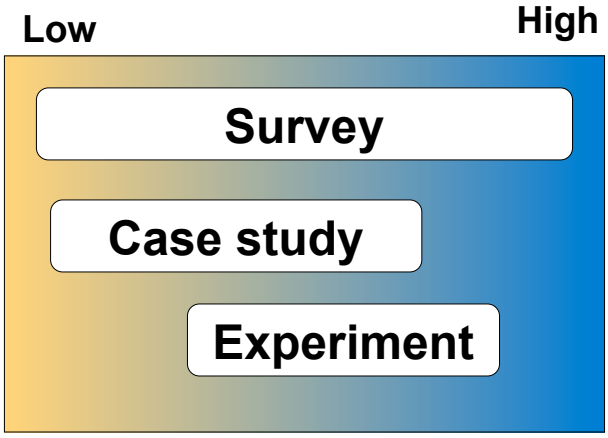
Low — High

Survey

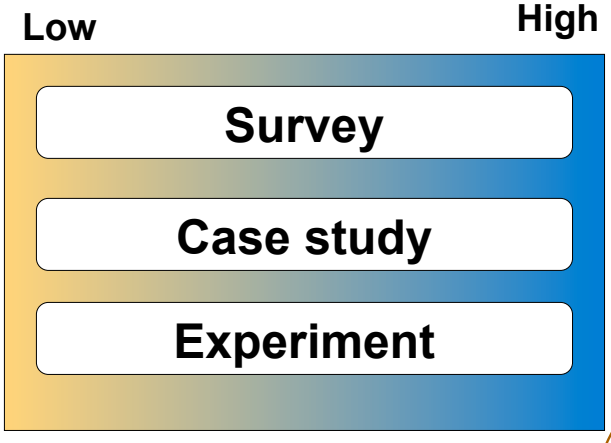
Case study

Experiment

External Validity



Reliability



Analysis

Validity - Countermeasures

Strategy	*Reactivity*	*Research-er bias*	*Respon-dent bias*
Prolonged involvement	**–**	**+**	**–**
Triangulation	**–**	**–**	**–**
Peer debriefing	**0**	**–**	**0**
Member checking	**–**	**–**	**–**
Negative case analysis	**0**	**–**	**0**
Audit trail	**0**	**–**	**0**

[Robson 2002]

Task on "your" case study

- **Are there any quantitative data analyses?**
- **How are the results validated?**
- **Which types of generalization are made?**