Qualitative vs Quantitative research
&
Multilevel methods

How to include context in your research

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Content

- What is qualitative analysis and how does it differ from quantitative analysis?
- How to combine qualitative and quantitative research?
- Statistics: multilevel models

What is qualitative analysis?

- The quantitative paradigm is dominant over the qualitative one in many disciplines (Fielding & Schreier, 2001)

- Research in a natural context, with a low degree of control over the context and the subject (Camic, Rhodes, & Yardley, 2003a)

- Using qualitative data ≠ qualitative analysis.

  Nominal data can be used in quantitative research.

  In qualitative research qualitative data is not transformed into a nominal measurement scale.

Qual vs Quan (1)

Qualitative Paradigm	**Quantitative Paradigm**
naturalistic	positivistic
Give a complete detailed description	Summarize and categorize observations
Interpretation of behavior	Prediction of behavior
Know only roughly what you are looking for	Make explicit and clear what you are looking for

Qual vs Quan (2)

Qualitative Paradigm	**Quantitative Paradigm**
Design emerges during study	Design is explicit and clear in advance
Ends with hypotheses & theory	Begins with hypotheses & theory
Time consuming	efficient
detailed	Less detailed (summarize details in categories or numbers)

Qual vs Quan (3)

Qualitative Paradigm	**Quantitative Paradigm**
Make abstractions, concepts and hypotheses from details (Inductive)	Form abstractions, concepts and hypothesis in advance and check if you can find them back in the data (Deductive)
Part of to be observed data. Insider's point of view (emic).	Objective observer. Outsiders point of view (etic)

Main drawbacks of qualitative analysis

- **Inductiveness**
  - Adjust hypotheses to data
- **Hypotheses**
  - How to structure the research if you don't state explicit questions to start with?
- **Holistic observations**
  - How to generalize from a series of detailed descriptions?
- **Validity and reliability**
  - Can the results of a study are said to be valid and reliable if you do not have statistics to back the results up?

Why consider using a qualitative design?

- To include the context and setting in which human behavior takes place
  - **Context influences** human behavior and is an important part of the focus of study (McGrath & Johnson, 2003)
  - **Deal with contextual influences** instead of eliminating contextual variance or treating it as confounds
  - **infrequent or irregular** phenomena can be as important as behavior that occurs more often.

What kind of data do you get with qualitative analysis?

- Descriptive
- Patterns/categories are described based on the descriptive data
- Data is not transformed to numerical data

Validity in qualitative research (1)

Inference	**Validity**	**Explanation (Cook&Campbell 1979)**
Statistical	Statistical conclusion	Is the result a real result? (non-random, sufficient size, non-coincidental)
Causal	Internal validity	How certain are you that there is a causal relationship?
Construct	Construct validity	Are you measuring what you want to measure? How certain are you that an indicator is measuring a construct?
Generalization	External validity	How certain are you that a result can be generalized over people, time and setting?

Validity in qualitative research (2)

- Since qualitative research is descriptive and patterns are not recoded into numerical variables, statistical inferences can not be made.
- Internal, external and construct validity can be determined (Lund, 2005).

Q: What if you want statistical validity?

A: Combine qual with quan methods.

- multi-method approach (triangulation)
- One way to do this:
  1. qualitative research: observe, describe, find patterns and categories
  2. quantitative research: label categories with numbers, use statistics

Development of language use in toddlers

- the way toddlers use language in preschool
- in different situations and with different people
- the way this develops from age 2;6 to 4;0 years.
- Subjects are normally developing children

- Observations are made of 24 children in 3 preschools.
- Audio and video recordings are made every 3 months for approximately 1½ year.

Observation points

april	..	july	..	oct	..	jan	..	april	..	july	..	oct
xx		**xx**		**xx**		**xx**		**xx**		**xx**		**xx**
2;6		**2;9**		**3;0**		**3;3**		**3;6**		**3;9**		**4;0**

Data analysis

- qualitative: observe, describe, find patterns and categories
- quantitative: recode patterns to a nominal or ordinal scale (label categories with numbers), use statistics

General questions

- Development over time
- Inter subject variability: how do children differ from each other?
- Intra subject variability: How much variability is there within a child?
- Distinguish between progress and achievement. Compare growth curves.

Complications

- The qualitative approach leads to a detailed description of each individual child. Individual situations and behaviors of the subjects are emphasized. In other words, the study consists of multiple case-studies, instead of one group study.
- Children are in different preschools and have different teachers. This can influence their language use in the preschool. How do you account for these influences?

Multilevel analysis

- “Multilevel analysis is a general term referring to statistical methods appropriate for the analysis of data sets comprising several types of unit of analysis.” (Snijders, 2003)
- To **account for the influence of school** on the development of children, view the children as nested into schools.
- In my study: 24 toddlers belong to one of 3 preschools
  - Level 1 units: toddlers
  - Level 2 units: schools

Advantages multilevel models (MLM)

- emphasizes not only the individual but also the **social context**
- accounts for populations with a **hierarchical, nested structure**
- can be used with **repeated measures**, also in the case of missing data (Plewis, 1998)
- Allow covariates to be measured discrete or continuous at each level
- Allow outcomes to be discrete or continuous (Raudenbush, 1994)

Key terms of MLM

- **Hierarchy**: Organization from detailed to global levels
- **Level**: Part in hierarchy, consisting of a collection of units of one type. The most detailed level is level 1.
- **Unit**: Element belonging to a level
- **Nesting**: Collection of units belonging to a level

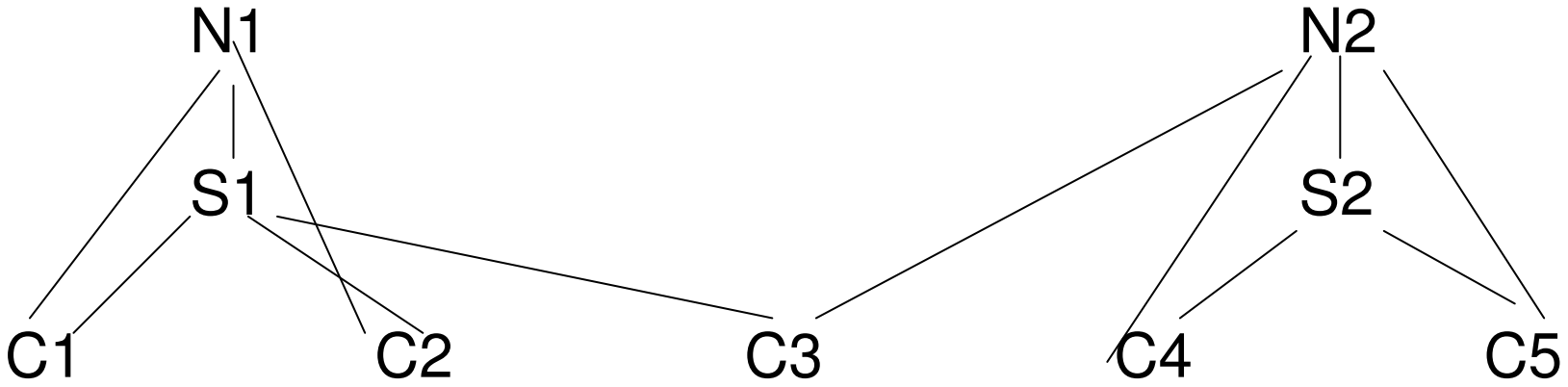
- **Error/residu**: Unexpected variance
- **Intercept**: true initial status
- **Slope**: growth rate

Nesting (1)

- Multilevel methods account for data that is nested in higher order data.
- **Nesting** means that a unit belongs to a category, which is a unit of another category higher in the **hierarchy**.
  - For example: a student belongs to a class, the class belongs to a school, the school belongs to an educational movement.

Nesting (2)

- Levels of analysis can be **nested** or **crossed** (Snijders, 2003).
- **Nested:** a lower level is nested in a higher level when the lower level is a **subset** of the higher level
- **Crossed:** higher levels are overlapping. It is easier to analyze nested levels than crossed levels



Hierarchical Linear Model (HLM)

- The main model of multilevel analysis
- Variant of regression analysis
- Designed for hierarchically structured data.

Features HLM

- Extension of General Linear Model (GLM)
- Errors (residuals) at every level
- Independent variables can be defined at any of the levels
- Can show **interaction effects** between levels.
  - express how context (macro level) affects relations between variables on the individual level (micro level).
  - For example, indicate how much college context (Z) influences the effect of individual achievement (X) on later income (Y) (Snijders, 2003).

Assumptions of HLM

- hierarchical data
- one dependent variable measured at lowest level
- independent variables measured at all existing levels

Example equation HLM (1)

- Question: How do annual incomes of university graduates 15 years after graduation depend on academic achievement in university?
  - Y = current income
  - X = average grade
  - i = graduate student
  - j = university
- Students are nested in universities
- (Example from (Snijders, 2003)

Example equation HLM (2)

Level 1 (Linear regression model):

$$\mathbf{Y_{ij} = \mathit{a}_j + \mathit{b}_j X_{ij} + E_{ij}}$$

- In words:
  - Yij: The current income of student i from university j
  - *a*j: initial status for someone in university j (intercept)
  - bj: growth rate for someone in university j (slope)
  - Xij: the average grade for student i from university j
  - Eij: individual random error

Example equation HLM (3)

Level 2 (crossed random effect model):

- *a*j: initial status for someone in university j (intercept)

$$a_j = a + U_{0j}$$

- In words:
  - *aj:* initial status for someone in university j
  - *a:* population mean initial status (all students together)
  - U_{0j}*:* university specific deviations from the population mean initial status

Example equation HLM (4)

Level 2 (crossed random effect model):

- bj: growth rate for someone in university j (slope)

$$b_j = b + U_{1j}$$

- In words:
  - bj: growth rate for someone in university j
  - *b:* population mean growth rate (all students together)
  - U_{1j}**:** university specific deviations from the population mean growth rate

Example equation HLM (5)

Level 2 (crossed random effect model):

- Fill in:

$$Y_{ij} = a_j + b_j X_{ij} + E_{ij}$$

$$Y_{ij} = a + U_{0j} + (b + U_{1j}) X_{ij} + E_{ij}$$

$$Y_{ij} = a + bX_{ij} + U_{0j} + U_{1j}X_{ij} + E_{ij}$$

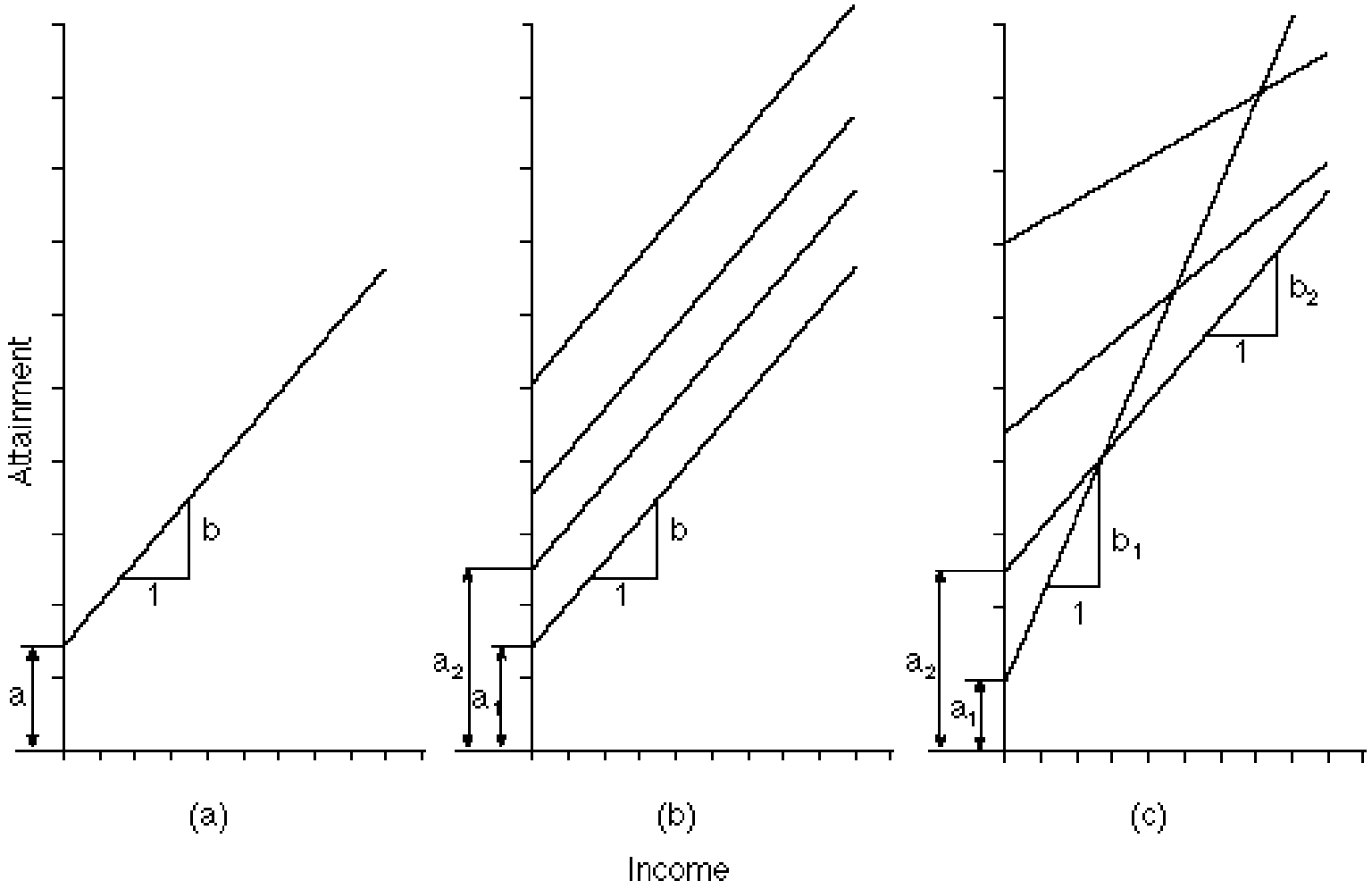
Fixed & random parts

- $\mathbf{Y_{ij} = \mathit{a} + \mathit{b}X_{ij} + U_{0\mathit{j}} + U_{1\mathit{j}}X_{ij} + E_{ij}}$
- $\mathbf{\mathit{a} + \mathit{b}X_{ij}}$
  - fixed part
  - a linear function of independent variables, like in linear regression analysis
- $\mathbf{U_{0\mathit{j}} + U_{1\mathit{j}}X_{ij} + E_{ij}}$
  - Random part
  - Reflects unexpected variation between graduates (E_{ij})
  - Reflects unexpected variation between universities (U_{0j} and $U_{1j}X_{ij}$)

Residuals (errors)

- $\mathbf{Y_{ij} = \mathit{a} + \mathit{b}X_{ij} + U_{0\mathit{j}} + U_{1\mathit{j}}X_{ij} + E_{ij}}$
- E_{ij}
  - Level 1
  - Varies over the population of students
- U_{0j} and U_{1j}
  - Level 2
  - Vary over the population of universities

Example picture (Plewis, 1998)



Repeated measures (1)

- By nesting the children in the schools, you account for the effect of school on the child's performance
- Longitudinal study:
  - For every child there are repeated measures.
  - Data points in a child are dependent.
  - Data points can be seen as nested in the children

Level 1: repeated measures

Level 2: children

Level 3: preschools

Repeated measures (2)

Advantage:

- not necessary for every child to have the same amount of data points. In other words **missing data is no problem.**

Repeated measures (3)

Dependence on time:

- Longitudinal data has a meaningful numerical time variable (e.g. age).
- Crucial relationship between dependent variable and time variable
- However, often the dependence on time is **nonlinear**.
  - use nonlinear transformation
  - use nonlinear models.

nonlinear versions of HLM

- If :
  - you can not assume that relations are linear
  - you can not assume that residuals are normally distributed
  - variables are **dichotomous**
  - Variables are **discrete** (fixed set of values, no values in between)
  - <30 units per level

Eg Bayesian hierarchical model

Web info

Qualitative research

- Forum Qualitative Sozialforschung/Forum: Qualitative Social Research http://www.qualitative-research.net/fqs/fqs-eng.htm

Multilevel models

- http://multilevel.ioe.ac.uk/publref/newsletters.html
- Prof Snijders, RuG http://stat.gamma.rug.nl/snijders/
- Prof Hox, UU http://www.fss.uu.nl/ms/jh/index.htm