Lecture Week 3
Quality of Measurement Instruments; Introduction SPSS

Introduction to Research Methods & Statistics
2013 – 2014

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Overview

- Quality of Measurement Instruments
- Introduction SPSS

Read:
- Leary: Chapters 3 (pp. 53-70)
Two aspects of the quality of a measure

Aim of research: explaining variability (week 1)
Ideal: variability measurement = variability characteristics

1. **Reliability** = the extent to which we measure correctly, i.e. without measurement error (random error).

2. **Validity** = the extent to which we measure what we intended to measure, i.e. without bias (systematic error).
Reliability

= the extent to which we measure without measurement error

\[
\text{Total Variance} = \text{Systematic Variance} + \text{Error Variance}
\]

\[
\text{Observed score} = \text{Systematic score} + \text{Error (Meas. Err.)}
\]

Reliability = Proportion Variance Accounted For

\[
\text{Reliability} = \frac{\text{Systematic (true score) variance}}{\text{Total (observed) variance}}
\]
Reliability coefficient

Lies between 0 and 1.  
Rule of thumb: .70 or higher is sufficient  
Determine with repeated measurement

1) Test-retest reliability  
2) Parallel form reliability  
3) Interitem reliability (also: Internal Consistency)  
4) Replication (whole study)

NOTE! For diagnostic purposes higher reliability required!
Reliability coefficients (1)

1) **Test-Retest Reliability**
   - *One measurement or whole instrument*
   - Measure twice and compare outcomes
   - Consistency of a measurement over time

2) **Parallel Form Reliability**
   - *One measurement or whole instrument*
   - Same as test-retest, but with two parallel instruments
Reliability coefficients (2)

3) **Interitem Reliability** (also: **Internal consistency**)
   - *For whole instrument*
   - Coherence of the items in the instrument (scale)

4) **Replication**
   - *For whole study*
   - Repeat the whole study and compare the outcomes
Internal Consistency

Instrument consists of items that all (aim to) measure the same underlying construct / concept.

Repeated measurement:
- Each item is a small measurement instrument
- All items are parallel test forms of each other

Respondents’ scores on items are consistent
High-high and low-low (Beware of reverse scoring)

**Beware!** Internal consistency will always be high if you ask almost the same question 10 times → remember content validity!
Measures of Internal consistency

1) Item-total correlation

2) Split-half reliability

3) Cronbach’s Alpha
Assessing Cronbach’s $\alpha$

The closer to 1 the higher the Internal consistency

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<th>$\alpha$</th>
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<tr>
<td>&lt; .60</td>
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<tr>
<td>.60-.80</td>
<td>Reasonable</td>
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<tr>
<td>&gt; .80</td>
<td>Good</td>
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</table>

Note. For diagnostic purposes higher $\alpha$ required!
Reliability: Categories of error variance

- Observed score (the measurement)
- Systematic score (true score)
- Error (Meas. Err.)

1) transient states
2) stable attributes
3) situational factors
4) characteristics of the measure
5) mistakes
Increasing the reliability of a measure

→ Eliminating measurement error

1) Standardize administration of the measure
2) Clarify instructions and questions
3) Train observers
4) Minimize errors in coding data
Validity

\[ y = \sum_y \alpha + \beta + \epsilon \]

Note: Validity requires Reliability, but not the other way around.
Validity Measurement Instruments (1)

1) **Face validity**
Does it appear to measure what it’s supposed to measure?

2) **Content validity**
   - does the measure cover all aspects of a construct?
   - requires independent observers

**Note:** Not in Leary
Validity Measurement Instruments (2)

3) **Construct Validity**
Does a measure relate to other measures as it should?
   a) **Convergent validity**: Strong correlations with instruments that measure comparable or opposing constructs
   b) **Discriminant validity**: weak / no correlation with instruments that measure different constructs

4) **Criterion-Related Validity**
Does a measure relate to a particular behavioral criterion?
   a) **Concurrent Validity**: present behavior
   b) **Predictive Validity**: future behavior
Validity of a Study

**Statistical Validity**: Was data analysis done correctly?

**Internal Validity**: Have alternative explanations been ruled out?

**External Validity**: Is the result *generalizable*?

**Construct Validity**: Are all measurement instruments valid?
SPSS – Variable view (1)
SPSS – Variable view (2)

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</tr>
</tbody>
</table>
SPSS – Variable view: Type
SPSS – Variable view: Values (1)
SPSS – Variable view: Values (2)
SPSS – Variable view: Missing
SPSS – Variable view: Measure
SPSS – Menu: Data
SPSS – Menu: Transform
SPSS – Menu: Analyze
SPSS – Menu: Graphs
SPSS – Menu: Help
What have you learned today?

- What are reliability and validity?
- What are the different types of reliability?
- What are the different sources of random errors?
- What are the different types of validity?
- How to interpret a reliability coefficient.
Next week

Inspecting data: Distributions

Read:
Leary: Chapter 6
Howell: Chapter 2