



University of
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Multidimensionality Continued II

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Multidimensionality

The Rasch model assumes that a questionnaire measures only one single latent trait or construct.

In presence of multidimensionality, the ability estimates can be expected to differ across dimensions.

Multidimensionality

Another Diagnostic Approach

Comparing person ability estimates across dimensions of the scale.

For a unidimensional scale, the ability of the persons should not differ significantly across dimensions.

This approach works for testing if a scale has two dimensions instead of one.

Multidimensional Rasch Analysis

Proportion of significant T-tests

Items loading opposite on the first component of a principal component analysis, can describe different dimensions (PC1⁺ and PC1⁻).

The significance of the opposition has to be tested statistically.

The ability estimates from the first and the second dimension can be compared with a T-test.

$$t_{(1,\infty)} = \frac{\hat{\theta}_{PC^+} - \hat{\theta}_{PC^-}}{\sqrt{SE_{\hat{\theta}_{PC^+}}^2 + SE_{\hat{\theta}_{PC^-}}^2}}$$

Doing as many paired T-tests as they are individuals in the sample, i.e. for each pair of ability estimates. What are the proportion of significant T-tests? Ideally, in presence of unidimensionality < 5%.

However, we cannot just compare the ability estimates from two separate Rasch analyses, as they are not calibrated on a common continuum.

Multidimensional Rasch Analysis

Anchored Rasch analysis – A Recipe



1. Run a unidimensional Rasch analysis with all items.
2. Determine the dimensions (items loading + or – on the PC1).
3. Set aside the common item parameter estimates.
4. Anchor the items from each dimensions on these difficulty estimates in 3)
5. Run separate Rasch analyses with anchored difficulty estimates and extract the person parameter.
6. Make a T-test for each pair of ability estimates (Formula).
7. Find the proportion of pairs of ability estimates with a significant difference ($|t\text{-value}| > 2.5$)
8. If the proportion in 6) is $> 5\%$, unidimensionality must be rejected.

Let's go to R-Studio

Open the R-Script MS10_Rscript.r from the OLAT or the MS-Teams Course Materials.

Exercise

Reproduce and reflect about the steps for the t-test for multidimensionality with the SRG-Data. Show that the coefficients from the common calibration are identical with those from the anchored analysis.