



University of
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Item Fit

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Item Fit

How accurately or predictably questionnaire items **fit** the Rasch model

Infit and Outfit

To find the item fit requires computation of:

1) Expected response for each observation X_{ij}

$$E_{ij} = \sum_{k=0}^{m_i} k(P_{ikj})$$

2a) The score residual Y_{ij}

$$Y_{ij} = X_{ij} - E_{ij}$$

2b) The standardized residual Z_{ij}

$$Z_{ij} = \frac{Y_{ij}}{(W_{ij})^{1/2}}$$

The variance of X_{ij} is formalized as

$$W_{ij} = \sum_{k=0}^{m_i} (k - E_{ij})^2 P_{ikj}$$

Infit and Outfit

3) A chi-square statistic by summing the standardized residuals.

$$\chi^2 = \sum_{n=1}^N Z_{ij}^2$$

The chi-square divided by the sample size corresponds to the Mean-Square Outfit Statistic.

$$Outfit_i = \frac{\sum_{n=1}^N Z_{ij}^2}{N}$$

The Outfit Statistic is sensitive to outlier. To diminish the effect of outlier, the standardized residuals can be adjusted by their variance. This is the Mean-Square Infit Statistic.

$$Infit_i = \frac{\sum_{n=1}^N W_{ij} Z_{ij}^2}{\sum_{n=1}^N W_{ij}}$$

Underfit and Overfit

An item is fitting the Rasch model if the Infit and Outfit statistics are close to 1.

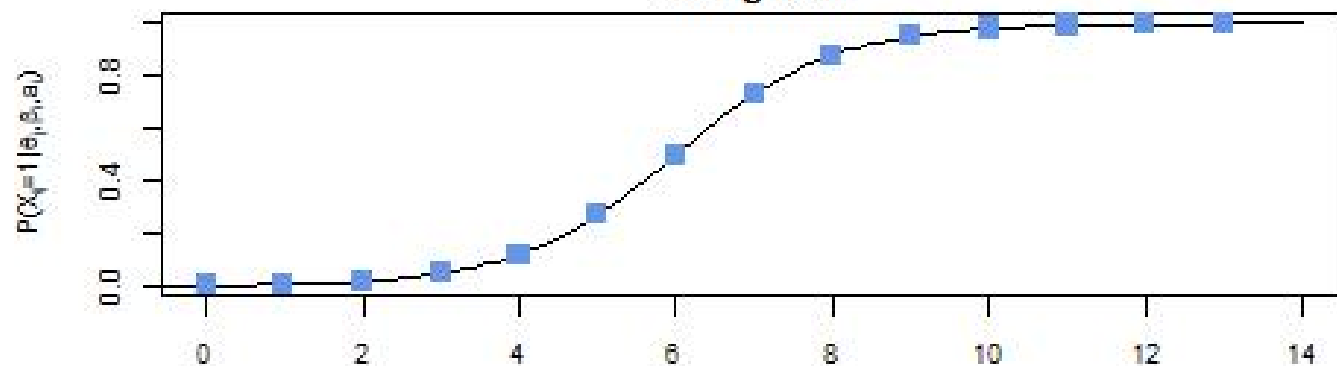
Underfit indicates underdiscrimination, the information is «blurred». It is not possible to differentiate ability levels. Underfit is found when the Infit or Outfit are much above 1.

Overfit indicates overdiscrimination, the information is too «sharp». An overdiscriminating item acts like an on-off switch. Underfit is found when the Infit or Outfit are much below 1.

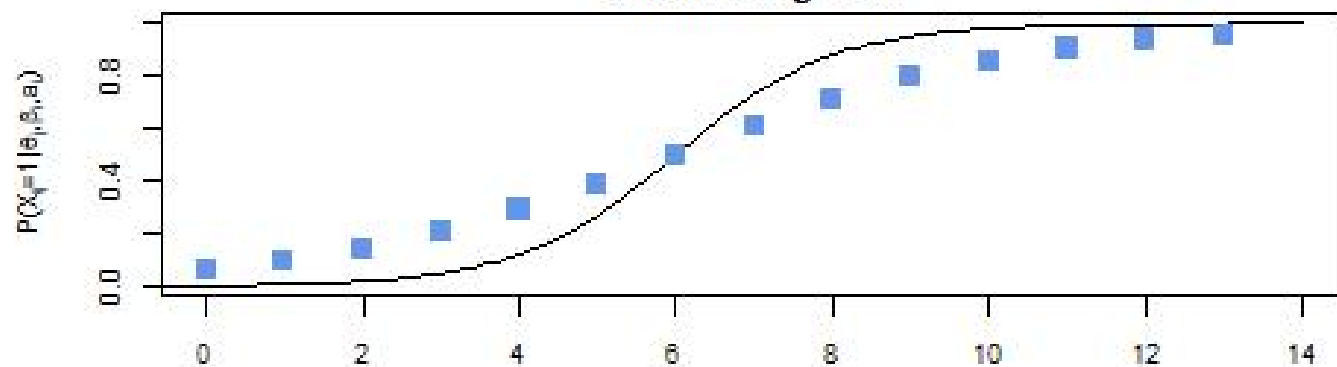
Note:

- Overfit is less critical for scales than underfit.
- Cut-off for acceptable fit, in terms of how much underfit can be tolerated, depends on the purpose of a scale.

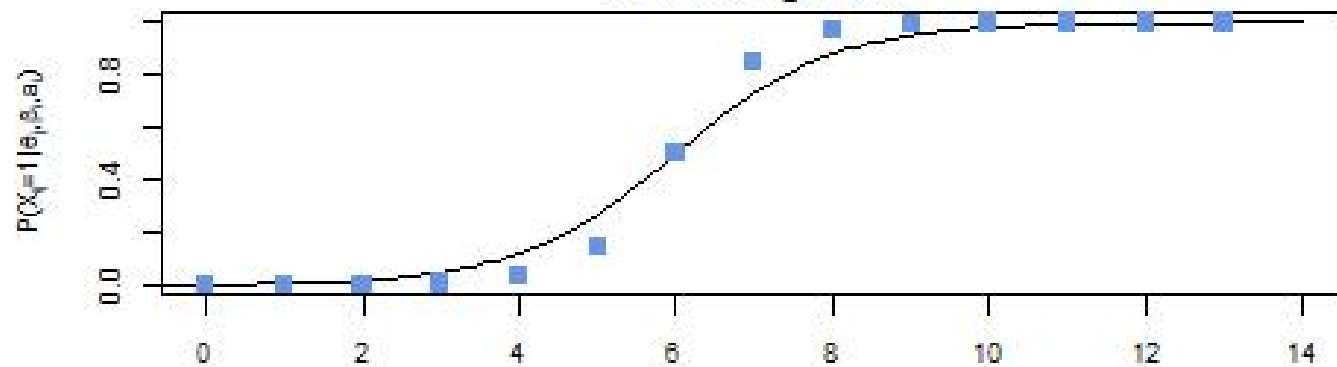
Fitting Item



Underfitting Item



Overfitting Item



Package
eRm

`RM()` : Dichotomous Rasch Model
`RSM()` Rating Scale Model
`PCM()` : Partial Credit Model

item difficulties
`thresholds()`

`plotICC()`
`plotPImap()`

`person.`
`parameter()`

reliability:
`SepRel()`

item fit
`itemfit()`

std.
residuals:
`residuals()`

pers. abilities:
`$theta.table`

Package
stats

LID
`cor()`

DIF

Package
utils

Multidimensionality –
PCA analysis:
`prcomp()` / `eigen()`

Let's go to R-Studio

Open the R-Script MS3_Rscript.r that you find in the OLAT or the MS-Teams Course Materials.

Exercise

Smith (1998, p.78) suggests cut-off based on sample sizes. Have a look at the article. Write down the two formulas and calculate the reasonable cut-offs for infit and outfit. Discuss item fit of the SRG-data under this light.