University of Zurich[UZH]

Targeting and Reliability

Master Rasch Seminar 4 – 07.10.2020

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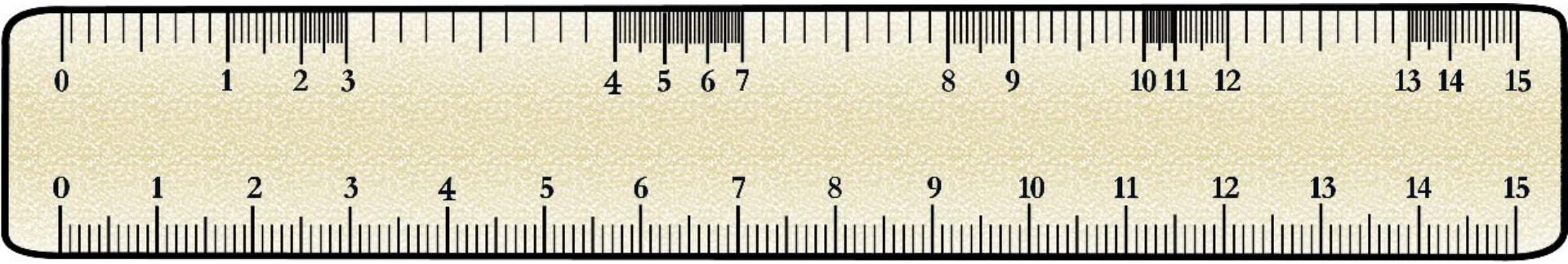
Our goal

Going from ordinal…

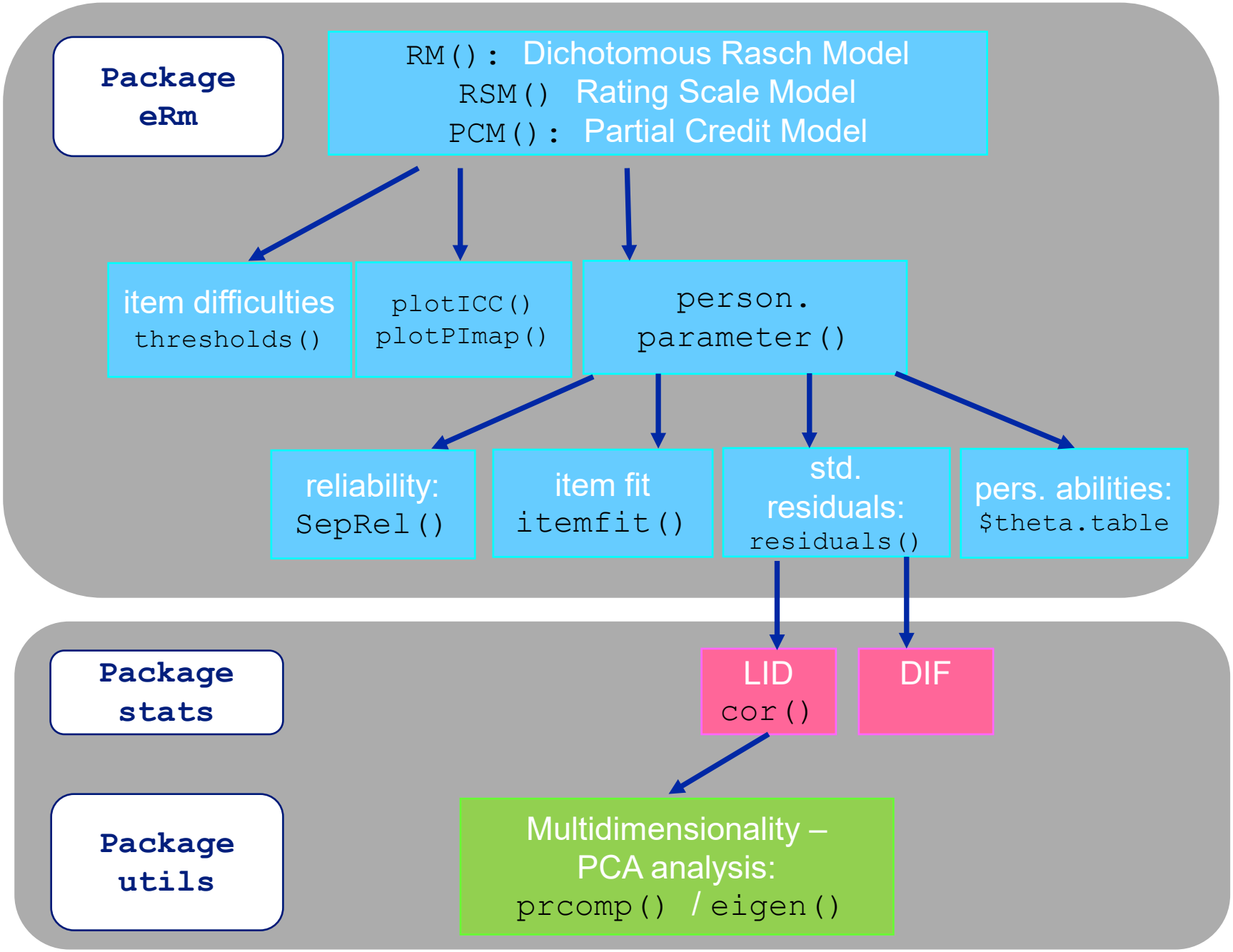


…to interval

Rasch Analysis

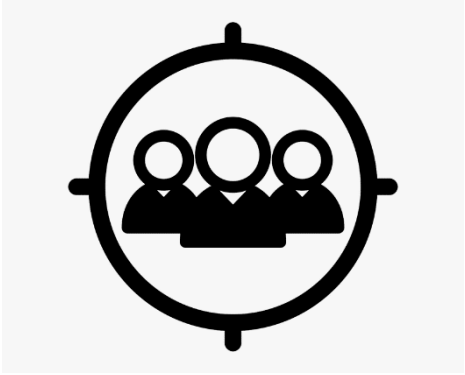
Rasch analysis is frequently applied to verify if an instrument shows important (psycho)metric properties.

- Stochastic ordering (fit of data to model)
- Monotonicity (ordering or response options)
- No local response dependencies or LID (no significant correlations between items)
- Unidimensionality (one latent construct)
- No differential item functioning or DIF (no sample subgroup effects)


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()

Targeting

Targeting indicates the degree to which the study population is outside the target range of the scale items



Targeting

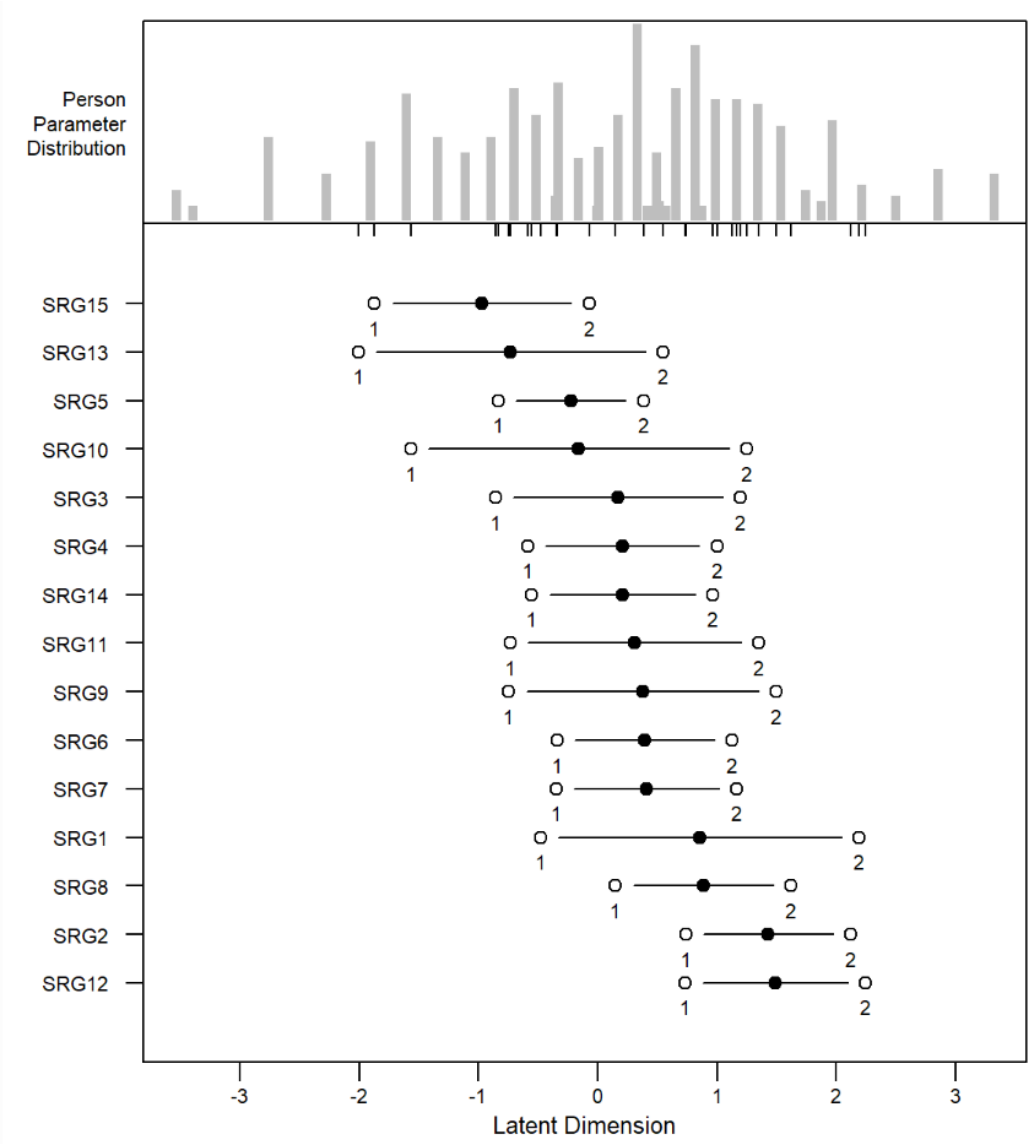
Item Difficulties approximate the person abilities

Characteristic of a well-targeted scale:

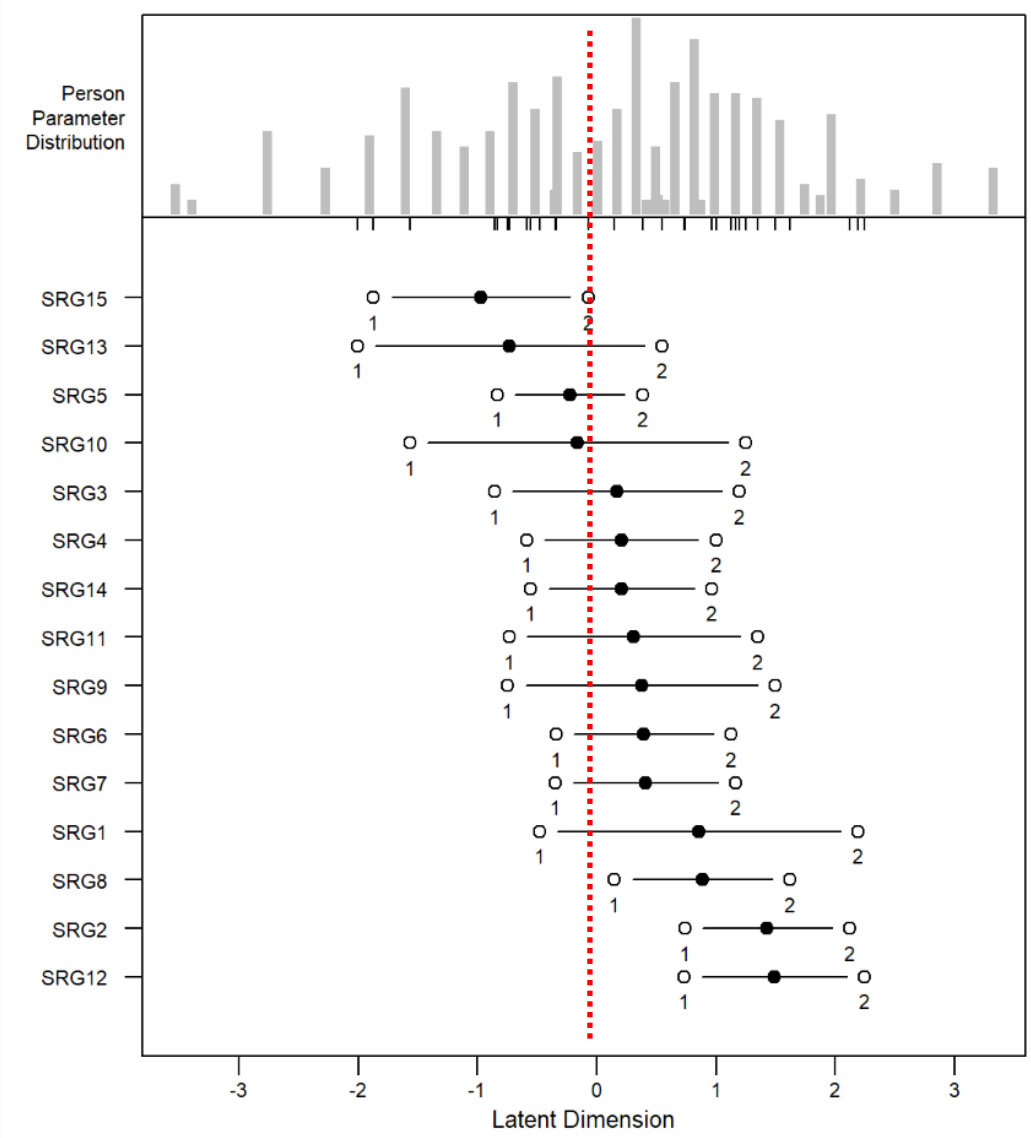
Difference mean difficulty and mean ability < 1 logit.

The SD of the item difficulty < 2.5
The SD of the person ability < 2.5

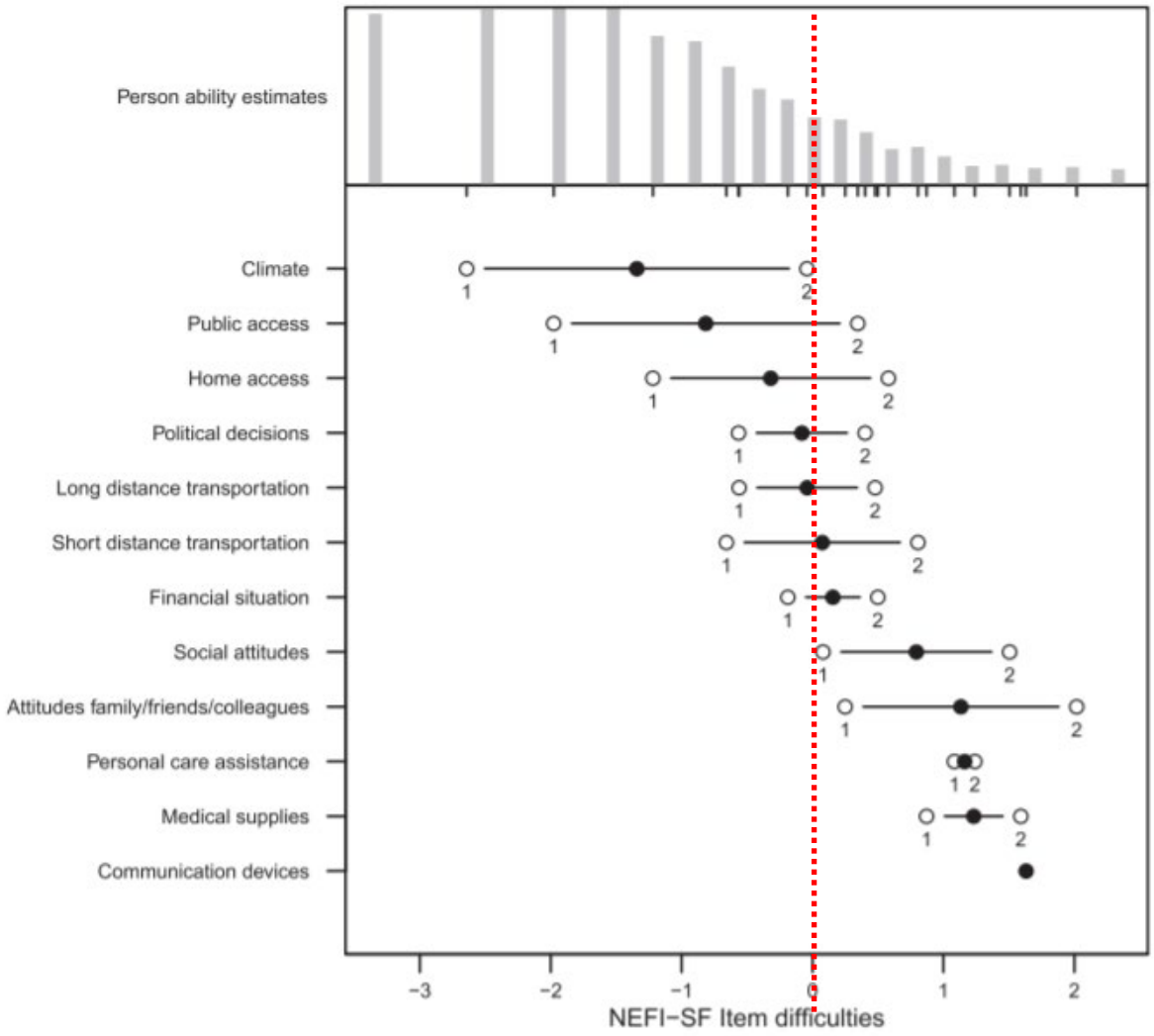
Person Item Map



Person Item Map



Person Item Map



Reliability

The reliability of any set of measurements is logically defined as the proportion of their variance that is true variance.

Total variance of a set of measures consists of two sources of variance: true variance and error variance.

The true variance is assumed to be the genuine value of whatever is being measured.

The error variance occurs independently and at random.

Reliability

In the context of Modern Test Theory, reliability is a function of the variability and precision of the person ability estimates.

The Person Separation Reliability (PSR), calculates the proportion of person variance that is not due to error.

$$PSR = 1 - \left[\frac{MSE_p}{SD_p^2}\right]$$

MSE : Mean Square Person Measure Error
SD^2: The sample person measure variance

Reliability

The PSR ranges between 0 and 1.

PSR > 0.9 :
very good reliability, scale can be used for individual measurement

PSR > 0.85
good reliability, scale can be used for measurement at population level.

PSR > 0.7
low, but just sufficient reliability

PSR < 0.7
Insufficient reliability, scale cannot differentiate levels of abilities.

The Information function

Information: the reciprocal of the precision.

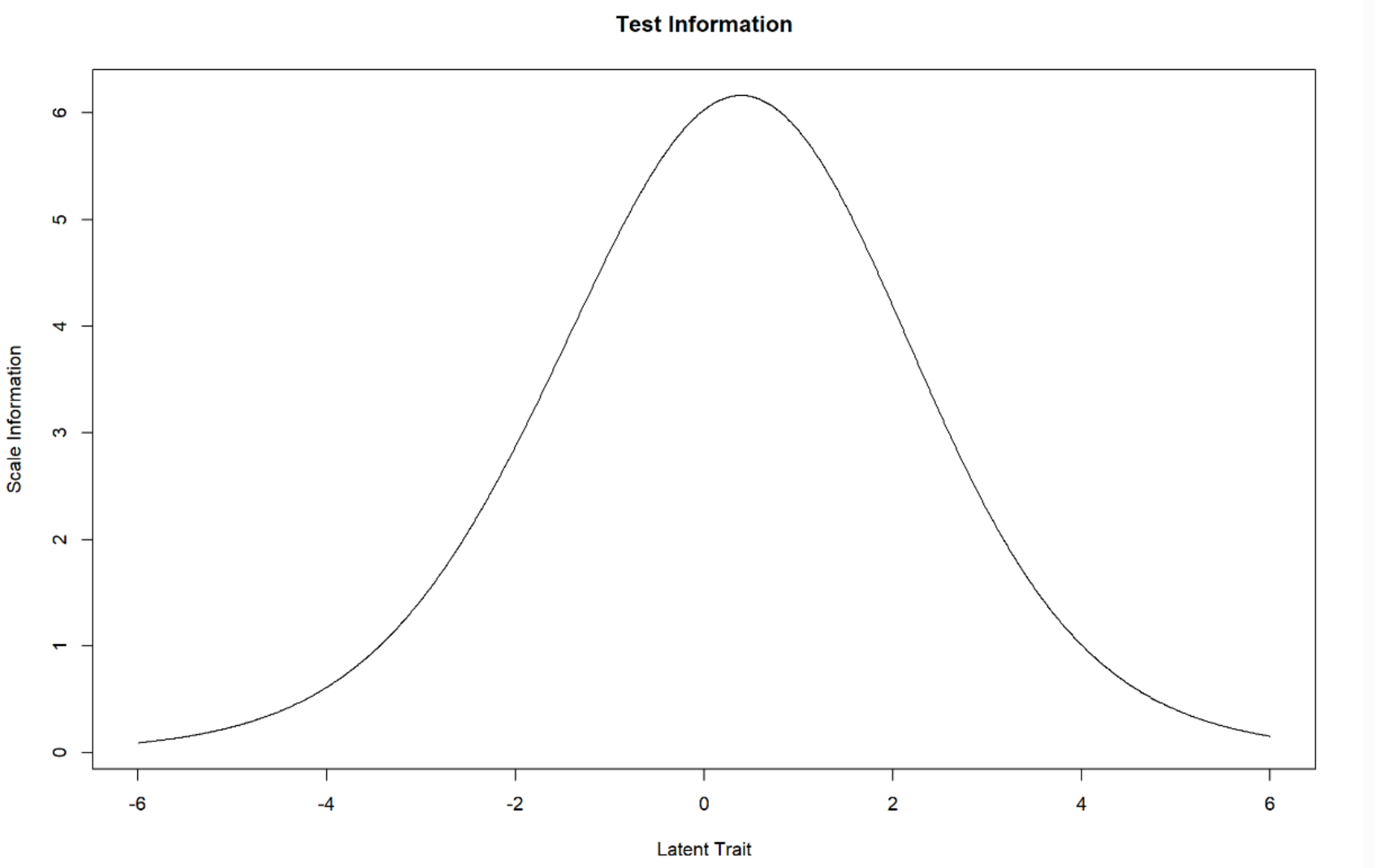
$$I = \frac{1}{\sigma^2}$$

The σ is the measurement precision of an ability estimate.

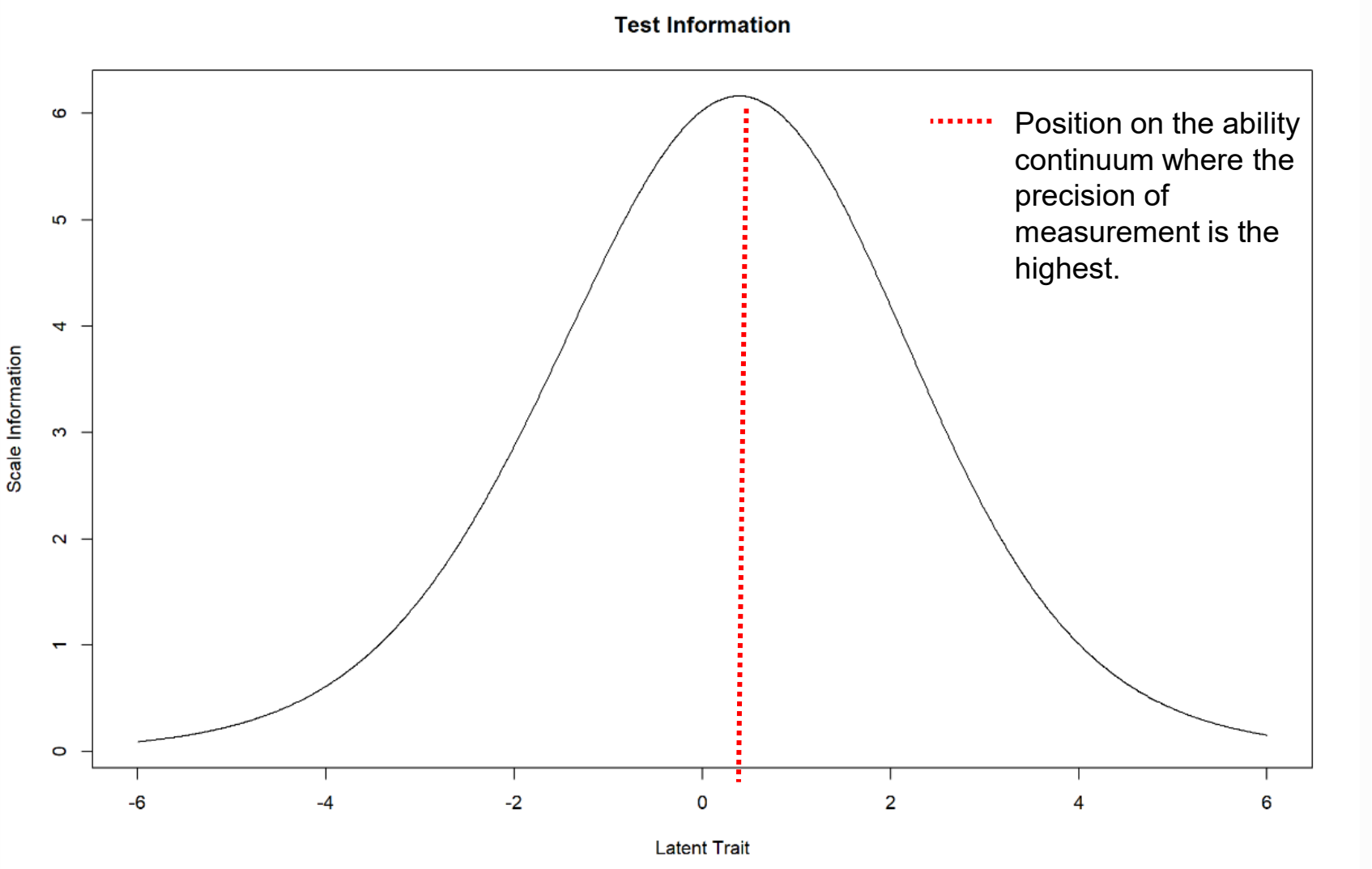
A large value of I means that the ability at a certain level can be measured with high precision.

A small value of I indicates lack of precision in the estimation of the ability.

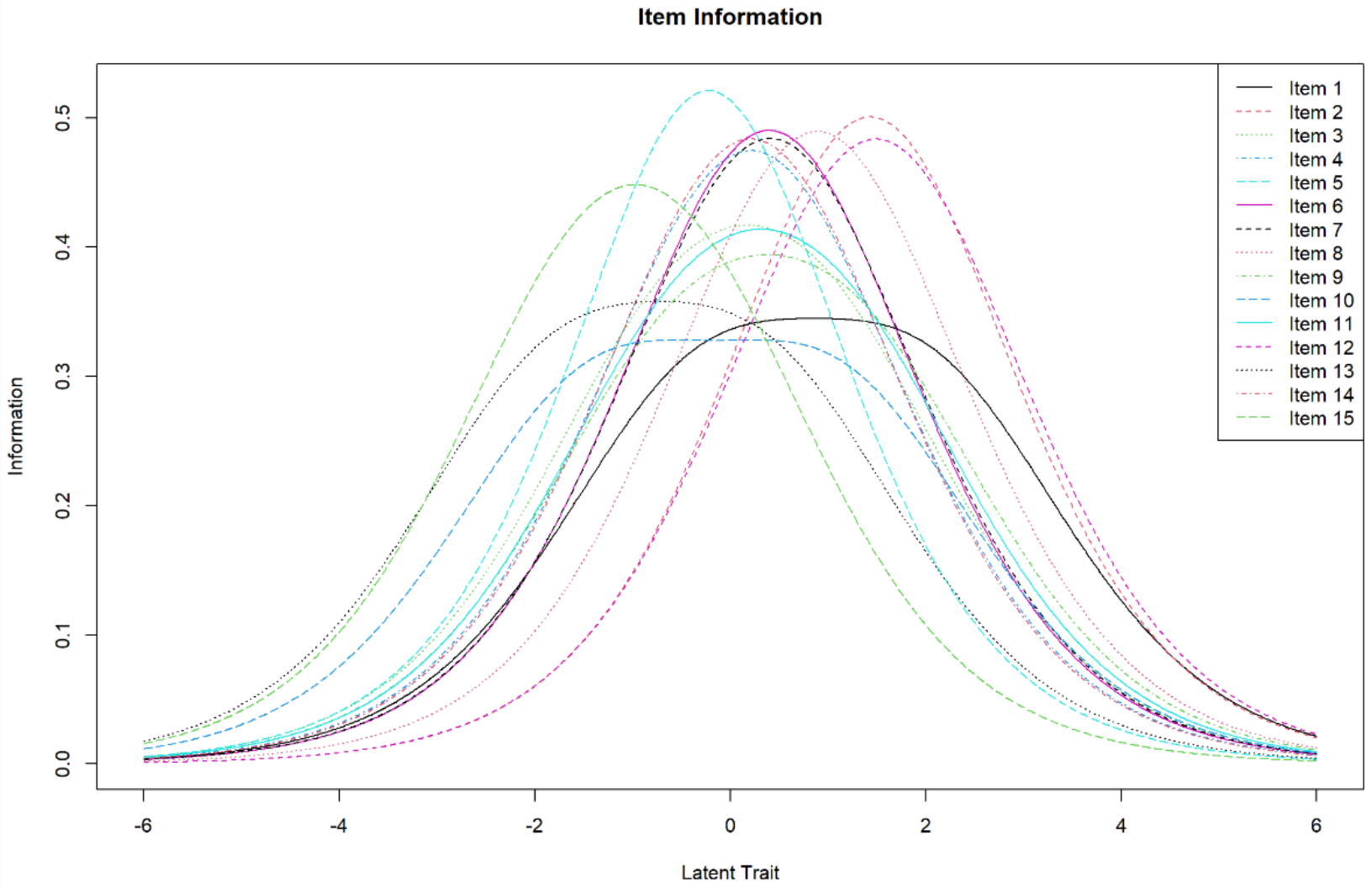
Test Information Curve



Test Information Curve



Item Information Curve



Let’s go to R-Studio

Open the R-Script MS4_Rscript.r from the OLAT or the MS-Teams Course Materials.

Exercise

The sample contains persons with different characteristics. Are there subgroups for which the general targeting of the scale is more adequate. Compare the mean ability of persons with
a) tetraplegia and with paraplegia,
b) males and females,
c) traumatic and non-traumatic injuries.