Lab 13

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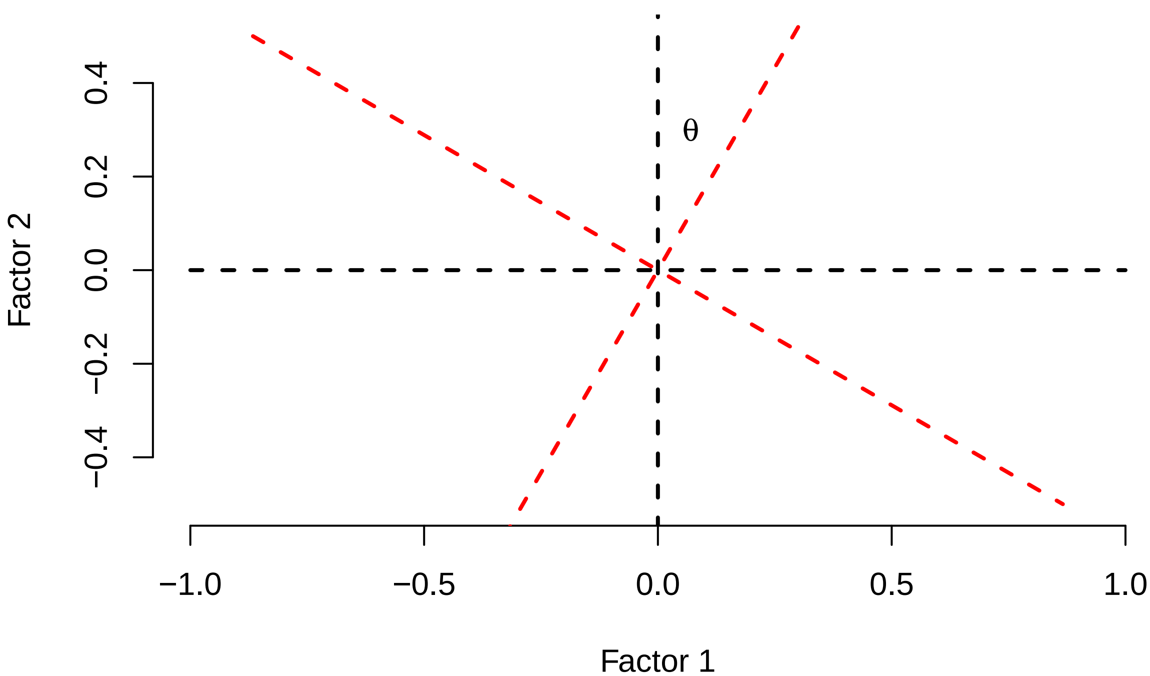
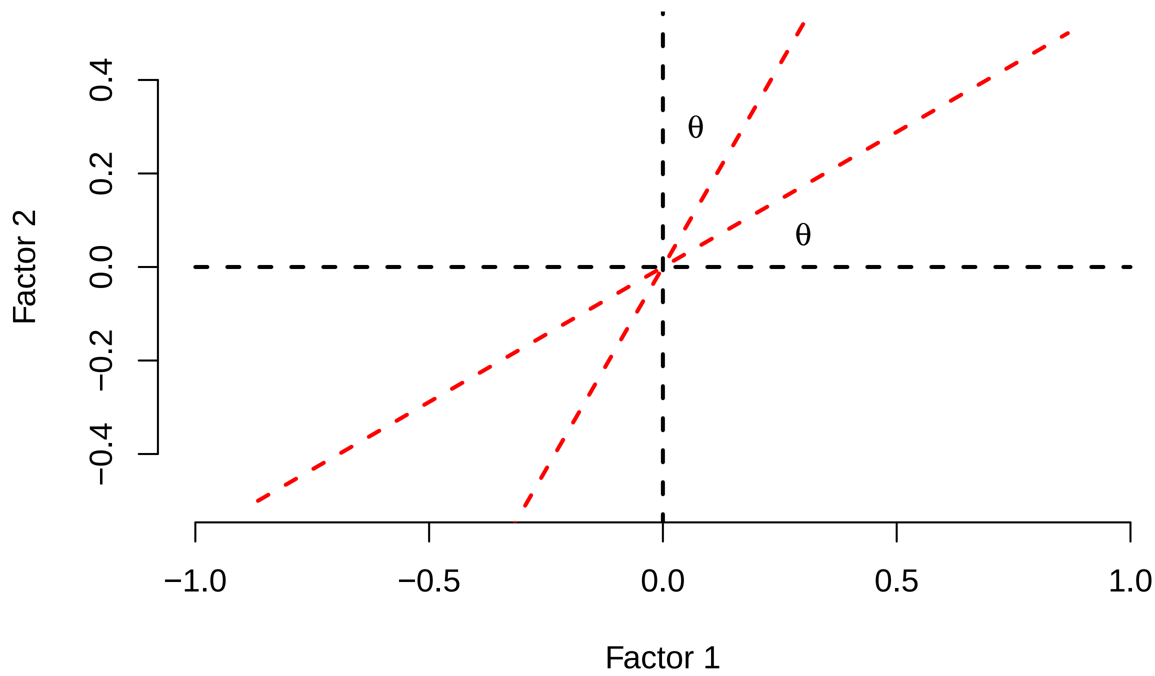
Factor rotation

- After extraction of factor the obtained loadings will be high for the 1st factor and low for any other factor.
- To make interpretation easier loading matrix is rotated. Think of rotation as of change of perspective in the multidimensional space.
- You will usually use orthogonal rotation - which assumes that the correlation between factors is equal to 0 - or oblique rotation which assumes some amount of correlation between factors.
- Whether to use orthogonal or oblique rotation depends on theoretical reasons. Selecting the proper one may make the interpretation of factors easier.

Orthogonal factor rotation



Oblique factor rotation



Factor scores

- A very useful option after doing EFA, is a possibility to save factor scores to your datasets (assuming you have obtained satisfactory solution).
- These can be used as an alternative to composite scores (sum or mean) computed by hand.
- Usually FS have mean of 0, and standard deviation of 1. Depending on the method the can be correlated or not.
- Comparison of different method goes beyond the scope of this course.

Reliability analysis

- When taking any measurement we strive to obtain a score reasonably close to the true value.
- However obtained score always involve some amount of error. We can write the obtained as score as:

$X_t = X_\infty + X_e$,

where X_t = obtained score, X_∞ = true score, and X_e = error

- Also:

$var_t = var_\infty + var_e$

Reliability analysis

- Reliability is a proportion of the true variance to the observed variance, i.e. what part of obtained score is actually a signal and not noise:

$r_{tt} = var_\infty / var_t$

- After some more tranformations, we can find easy to calculate formula:

$r_{tt} = 1 - var_e/var_t$

- Note this is similar to the formula for R^2, in fact we can use correlation coefficient to calculate reliability score.

Reliability analysis

- Reliable measure will give similar results for each measurement.
- In other words, correlation between scores frome each measurement will be high.
- One way to estimate reliability of a measure is to take a measurement twice and to calculate the correlation between the 2 sets of scores.
- This is not the most convenient, and involves some methodological issues, e.g. learning.
- An alternative is to use *split-half reliability*, i.e. randomly splitting the scale and calculating correlation between the halves.
- However, there are many ways you can split the scale and each will probably give you slightly different result.

Reliability analysis

- To deal with the above problem with *split-half reliability*, Cronbach came up with a measure that is equivalent to splitting the scale in two in every possible way and computing the correlation coefficient for each possible split.

$\alpha = \frac{N^2\overline{Cov}}{\sum s^2_{item} + \sum Cov_{item}}$

Reliability analysis

- Usually value of Cronbach's α higher than .7 indicates reliable scale. With diagnostic or clinical tests you would rather need reliability higher than .9
- However, Cronbach's α depends on the number of items in scale. It increases with every item. Therefore you can obtain high α not because the scale is reliable, but because you have a lot of items in the scale.
- When computing α make sure that reverse coded items are recoded. Failure to do that result in very small or negative reliability coefficients.