Tutorial 4

Exercise 1.

The reliability of the tolerance scale, measured using Cronbachs α, was equal to 0.8645.

a. $r_{xx'} > 0.8645$ because the items are not paralel.

b. k = 30/18, thus:

$$r_{kk'} = \frac{Kr_{xx'}}{1 + (K - 1)r_{xx'}}$$

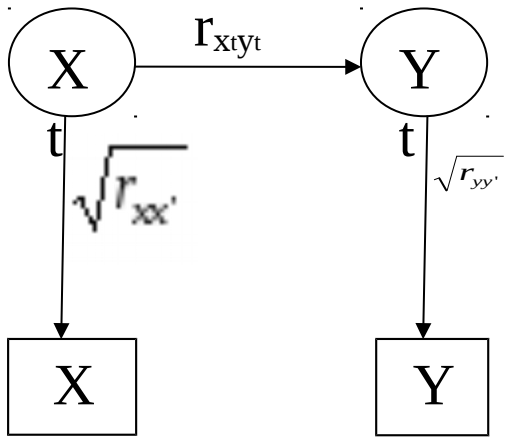
$$r_{kk'} = \frac{30/18 * 0.8645}{1 + (30/18 - 1) * 0.8645} = 0.914$$

Exercise 2.

The reliability of the tolerance scale, measured using Cronbachs α, was equal to 0.8645.

a.

$$r_{xy} = r_{xtyt}\sqrt{r_{xx'}}\sqrt{r_{yy'}}$$



r_{xy} is maximal in following optimal situation:

$r_{yy'} = 1$ and $r_{xtyt} = 1$

Include in the equation:

$$r_{xy} = 1\sqrt{0.8645}\sqrt{1} = 0.930$$

b. Asked to estimate:

r_{xtyt} and $r_{yy'}$

$$r_{xtyt} = \frac{r_{xy}}{\sqrt{r_{xx'}}\sqrt{r_{yy'}}} = \frac{0.2}{\sqrt{0.8645}\sqrt{r_{yy'}}}$$

1) What is maximal value of $r_{yy'}$?

If we assume $r_{yy'} = 1$, than $r_{xtyt} = 0.215$
That is over the given value, so we conclude that the maximum $r_{yy'} = 1$

2) What is minimal value of $r_{yy'}$?

If we assume $r_{yy'} = 0.01$, than
$r_{xtyt} = 2.15$. This cannot be as it is larger than 1!!

We can find minimum $r_{yy'}$ by assuming $r_{xtyt} = 1$ and then calculating the value from following equation:

$$1 = \frac{0.2}{\sqrt{0.8645}\sqrt{r_{yy'}}}$$

Minimal value is: $r_{yy'} = 0.046$

3) What is maximal value of r_{xtyt}?

This is 1 (see 2).

4) What is minimal value of r_{xtyt}?

r_{xtyt} cannot be zero, because $r_{xy} = 0,2$

True correlation has to be equal or larger than observed correlation: $r_{xtyt} \geq r_{xy}$

Difference between r_{xtyt} and r_{xy} is the smallest when X and Y are measured with maximum reliability: $r_{xy} = r_{xtyt}\sqrt{r_{xx'}}\sqrt{r_{yy'}}$

Thus, assuming $r_{yy'} = 1$ we can obtain the minimal value, which is $r_{xtyt} = 0.215$ (also see 1)

Exercise 3.

It can be that a concept consists of sub-concepts that are not significantly correlated with each other.
The internal consistency of questions about the concept can then be lower then the internal consistency of parts of the concept. Thus, removing all questions about one part of a concept could increase internal consistency but worsen (concept) validity.

NB: Make sure that the questions are not essentially the same, with only slightly different wording; this can increase the Cronbach's alpha but it does not make test more valid; it only makes it longer and thus more difficult to administer.

Exercise 4.

Statements:

(I) If a test has a high reliability, it can still be possible that the test does not have a high criterion validity (rxy = 0).

This statement is correct.
For example: IQ test with reliability higher than 0.90 has little predictive value in determining if a person is male or female.

(II) A test can only have high criterion oriented validity if the reliability of both the test and the criterion is high.

This statement is correct. See the formula for correction for attenuation:

$$r_{xy} = r_{xtyt}\sqrt{r_{xx'}}\sqrt{r_{yy'}}$$

As reliability of X and Y decreases, so does r_{xy}.

Exercise 5.

Unfortunately, we don't have inter-correlations of the items; than we could easier detect the items that are exactly the same.

The questions will be deleted because of the following reasons:

Co3: 'well written', it is not really organization → there is no reference to teacher (construct validity)
Co6: divergence, not really organization (construct validity)
Co7: 'expresses himself unclearly' not connected with organization (construct validity)
Co9: divergence, 'understood' has nothing to do with organization (construct validity)

N.B.: CO2 & CO10 are also questionable:

Co2: questionable in terms of construct validity ‘pace easy to follow’.
Co10: questionable in terms of construct validity ‘hard to comprehend’.

Note: this scale is ‘Organization’ or maybe ‘clear explanation’? CO1 seems to be the ‘best’ item in the scale.

Cd1: because = Cd12
Cd3: small divergence
Cd7: because = Cd10
Cd11: small divergence, practical (construct validity)

Note: Several solutions are possible. Many items are similar and are about as good.

Cs4: small divergence and too long
Cs5: because = Cs2 and Cs2 > Cs5
Cs9: no divergence
Cs12: (construct validity) maybe not stimulation, also deals with studying and not with lecture/teacher.

Cv2: divergence, item-scale correlation, construct validity (no link with external material)
Cv6: there must be 1 more; divergence and construct validity.
Cv9: because = Cv5
Cv11: there must be 1 more; divergence and construct validity (link with external material?)

Cc1: divergence
Cc5: alpha, teacher → instead of the others
Cc8: there must be 1 more, relative contribution is smaller than for other items.
Cc9: no convergence (construct validity), divergence