Survey Savvy - Choosing the right Tool (Part Two)

Peter Smith

Overview

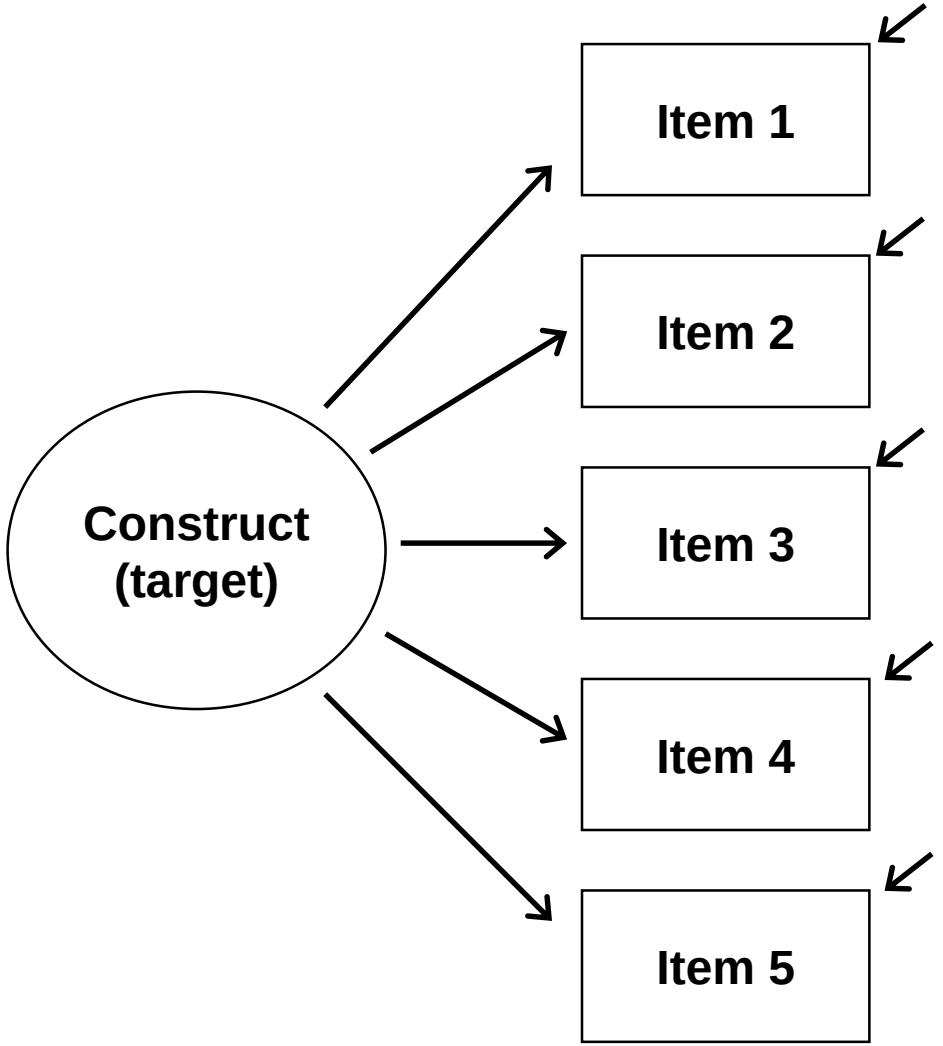
- How do we measure things we can't directly observe?
  - What is a latent construct/factor?
- Why alpha is a useless statistic for multi-dimensional scales
- Results from correlation and confirmatory factor analyses

How do we measure things we can't directly observe?

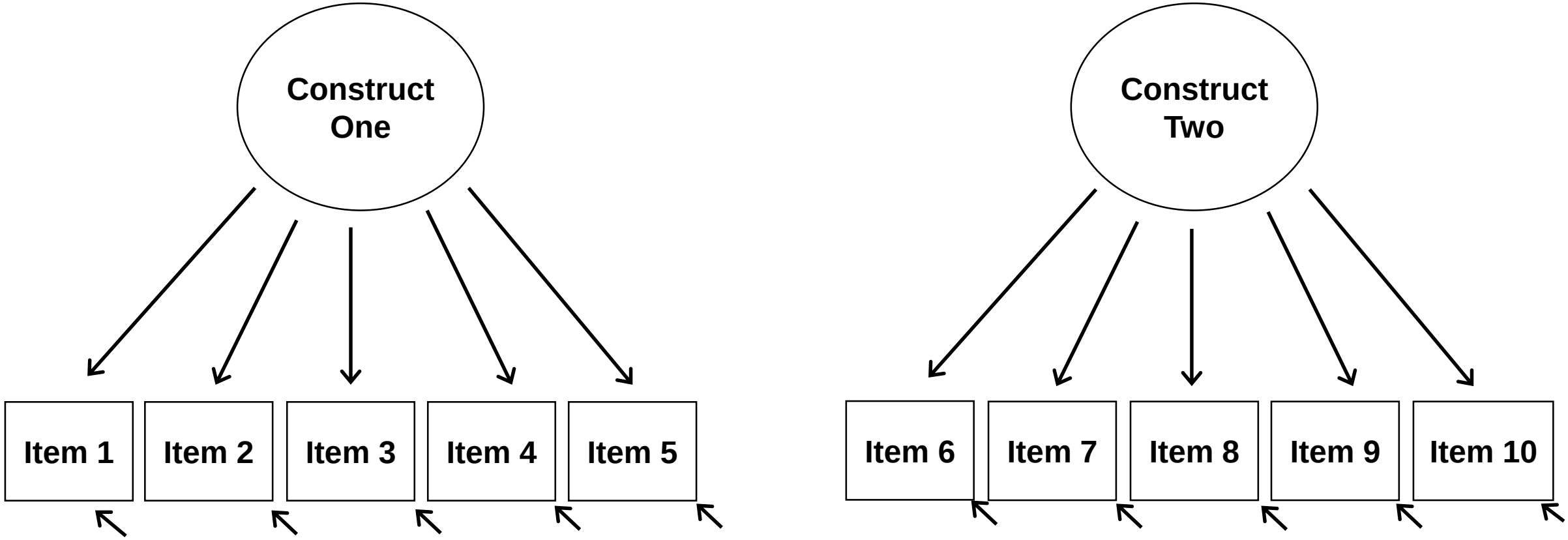
You can't observe someone's sense of mastery

However, if someone had high or low sense of mastery you could probably guess if they would agree or disagree with the following statements

1. You have little control over the things that happen to you
2. There is really no way you can solve some of the problems you have
3. There is little you can do to change many of the important things in your life



When it comes to the psychosocial work environment we often don't want to just measure one thing



When measuring more than one construct (dimension) of work ….

It’s important that we can distinguish between items that measure one construct from items that measuring another constructs

Otherwise you don’t know

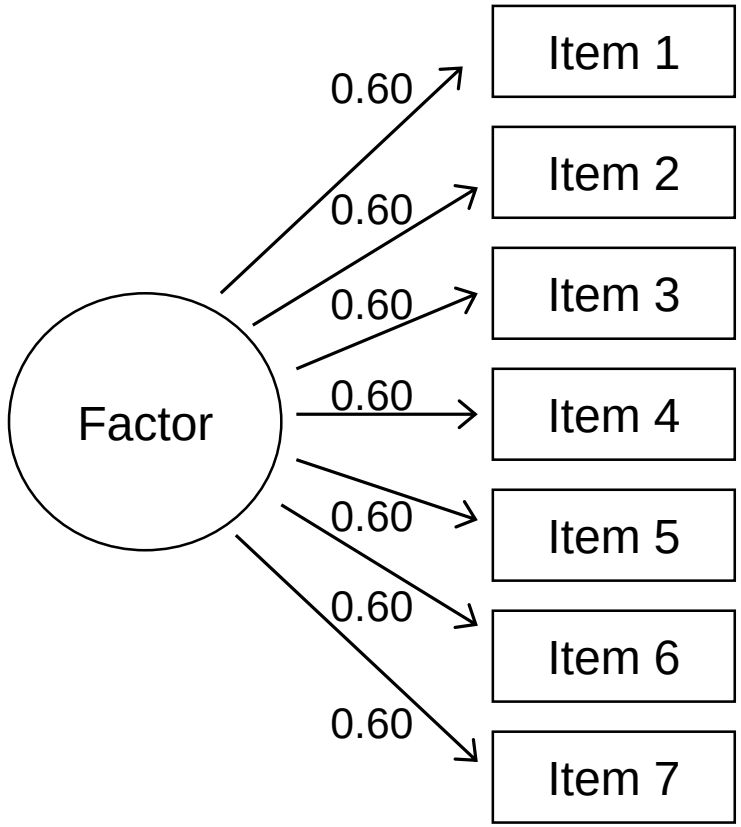
- If some dimensions are better/worse than other dimensions
- What things you need to target to improve the overall work environment
- If the things you do are successful in changing the things you wanted to change.

Factor analysis vs. Cronbach's alpha (aka "the worlds most useless statistic")

	Item						
	1	**2**	**3**	**4**	**5**	**6**	**7**
1	1.00						
2	0.36	1.00					
3	0.36	0.36	1.00				
4	0.36	0.36	0.36	1.00			
5	0.36	0.36	0.36	0.36	1.00		
6	0.36	0.36	0.36	0.36	0.36	1.00	
7	0.36	0.36	0.36	0.36	0.36	0.36	1.00

Eigenvalues

1	**2**	**3**	**4**	**5**	**6**	**7**
3.61	0.64	0.64	0.64	0.64	0.64	0.64



Cronbach's alpha = 0.80

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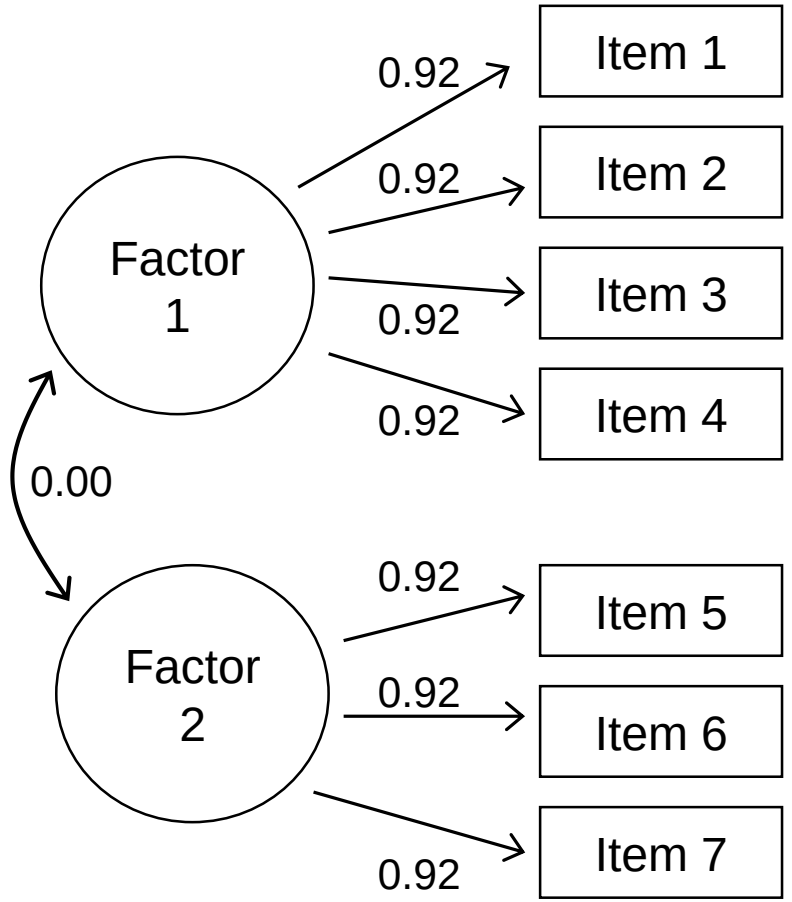
Factor analysis vs. Cronbach's alpha (aka "the worlds most useless statistic")

Item	1	2	3	4	5	6	7
1	1.00						
2	0.85	1.00					
3	0.85	0.85	1.00				
4	0.85	0.85	0.85	1.00			
5	0.00	0.00	0.00	0.00	1.00		
6	0.00	0.00	0.00	0.00	0.85	1.00	
7	0.00	0.00	0.00	0.00	0.85	0.85	1.00

Eigenvalues

1	2	3	4	5	6	7
3.55	2.70	0.15	0.15	0.15	0.15	0.15



Cronbach's alpha = 0.80

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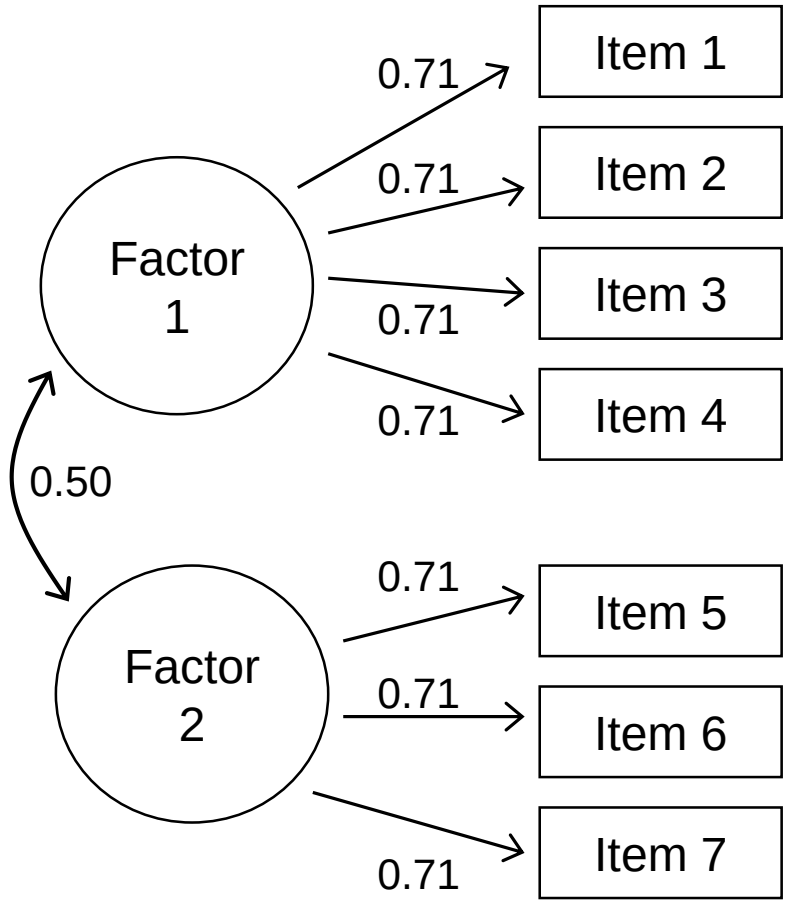
Factor analysis vs. Cronbach's alpha (aka "the worlds most useless statistic")

	Item						
	1	2	3	4	5	6	7
1	1.00						
2	0.50	1.00					
3	0.50	0.50	1.00				
4	0.50	0.50	0.50	1.00			
5	0.25	0.25	0.25	0.25	1.00		
6	0.25	0.25	0.25	0.25	0.50	1.00	
7	0.25	0.25	0.25	0.25	0.50	0.50	1.00

Eigenvalues

1	2	3	4	5	6	7
3.15	1.35	0.50	0.50	0.50	0.50	0.50



Cronbach's alpha = 0.80

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Two measures of the psychosocial work environment

Guarding minds at work

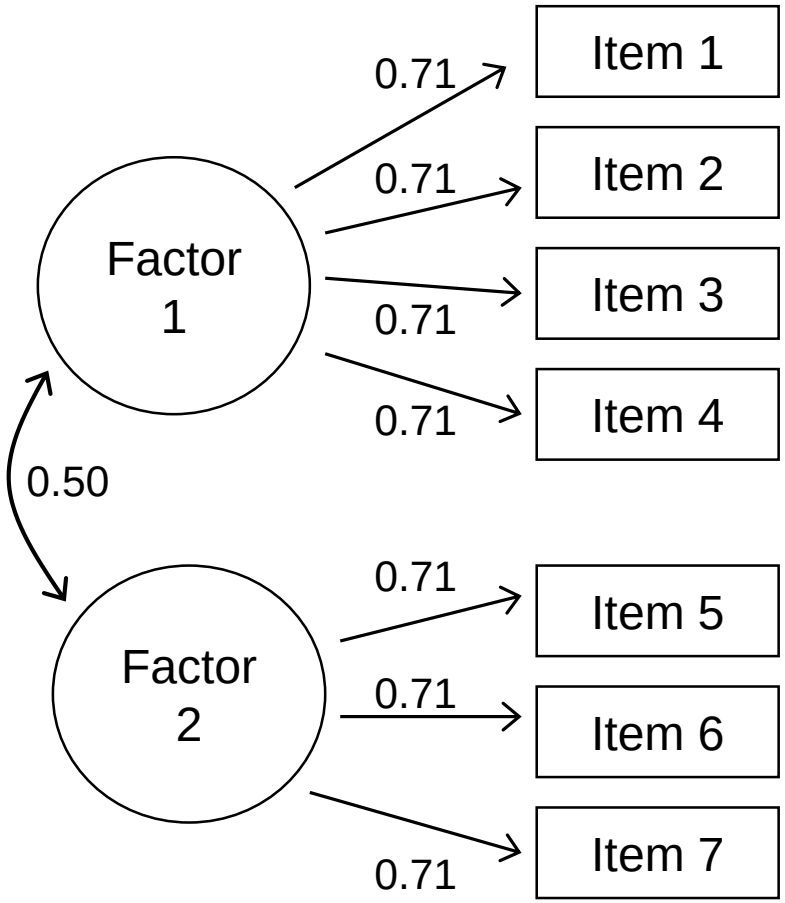
- 66 items
- 13 dimensions
- All dimensions reflected by 5 items
- Responses on 4-point agreement scale

COPSOQ

- 40 items
- 17 dimensions
- Dimensions reflected by two or three items
- Responses on 5-point (some frequency, some amount)

How are variables related to each other

	Item						
	1	2	3	4	5	6	7
1	1.00						
2	0.50	1.00					
3	0.50	0.50	1.00				
4	0.50	0.50	0.50	1.00			
5	0.25	0.25	0.25	0.25	1.00		
6	0.25	0.25	0.25	0.25	0.50	1.00	
7	0.25	0.25	0.25	0.25	0.50	0.50	1.00



GM@W average within dimension item correlation and item to external item correlation (N = 900)

Dimension	Within dimension	External item correlation
Psych support	0.53	0.46
Organisational Culture	0.57	0.48
Leadership and Expectations	0.54	0.47
Civility and respect	0.56	0.46
Psych competencies	0.40	0.42
Growth and Development	0.50	0.45

Dimension	Within dimension	External item correlation
Recognition and reward	0.50	0.46
Involvement and influence	0.51	0.47
Workload management	0.44	0.42
Engagement	0.48	0.33
Balance	0.51	0.43
Psych protection	0.60	0.50
Physical safety	0.62	0.42

COPSOQ average within dimension item correlation and item to external item correlation (N = 3,494)

Dimension	Within dimension	External item correlation
Quant demands	0.50	0.15
Work Pace	0.57	0.15
Emot demands	0.54	0.20
Influence at work	0.55	0.24
Development	0.48	0.21
Meaning of work	0.76	0.24
Commitment to work	0.55	0.30
Predictability	0.65	0.33
Rewards	0.70	0.37

Dimension	Within dimension	External item correlation
Role Clarity	0.71	0.29
Role Conflicts	0.61	0.25
Quality of leadership	0.66	0.29
Supervisor support	0.76	0.31
Job insecurity	0.42	0.17
Work Life conflict	0.58	0.22
Vertical Trust	0.65	0.32
Organisational justice	0.64	0.34

Size of extra-dimension item to item correlations

GM@W

N of correlations = 1,950

N 0.70 and above = 15 (0.8%)

N 0.60 to 0.69 = 152 (7.8%)

COPSOQ

N of correlations = 751

N 0.70 and above = 0 (0%)

N 0.60 to 0.69 = 13 (1.7%)

Examples of highly correlated items across dimensions in the GM@W survey

Item One	Item Two
I am informed of important changes that may impact how my work is done (Involvement & Influence)	I am informed about important changes at work in a timely manner (Clear Leadership & Expectations)
Our workplace effectively handles “people problems” that exist between staff (Civility and Respect)	Difficult situations at work are addressed effectively (Organisational Culture)
My immediate supervisor cares about my emotional well-being (Psychological Protection)	My supervisor would say or do something helpful if I looked distressed while at work (Psychological Support)
I am able to talk to my immediate supervisor about how I do my work (Involvement & Influence)	My immediate supervisor appreciates my work (Recognition & Reward)

Confirmatory Factor Analysis. How do you know if your measure is good?

- Your model converges
- The parameter estimates make sense
- Model goodness-of-fit statistics meet rules of thumb

Goodness of fit

Many goodness of fit statistics available, and it is recommended that you use a variety of statistics.

All based on comparing the model with the covariance matrix

- Absolute fit: concerned with the ability of the model to reproduce the data (e.g. chi-square (χ^2) statistic);
- Incremental Fit: concerned comparing two competing models (e.g. comparative fit index)
- Parsimonious fit: trade off between number of parameters estimated (one can always obtain a better fit by estimating more parameters) and model fit (e.g. Root Mean Square Error (RMSEA))

Goodness of fit: comparing the covariance/correlation matrix (left) with the proposed model (right)

	Item						
	1	2	3	4	5	6	7
1	1.00						
2	0.50	1.00					
3	0.50	0.50	1.00				
4	0.50	0.50	0.50	1.00			
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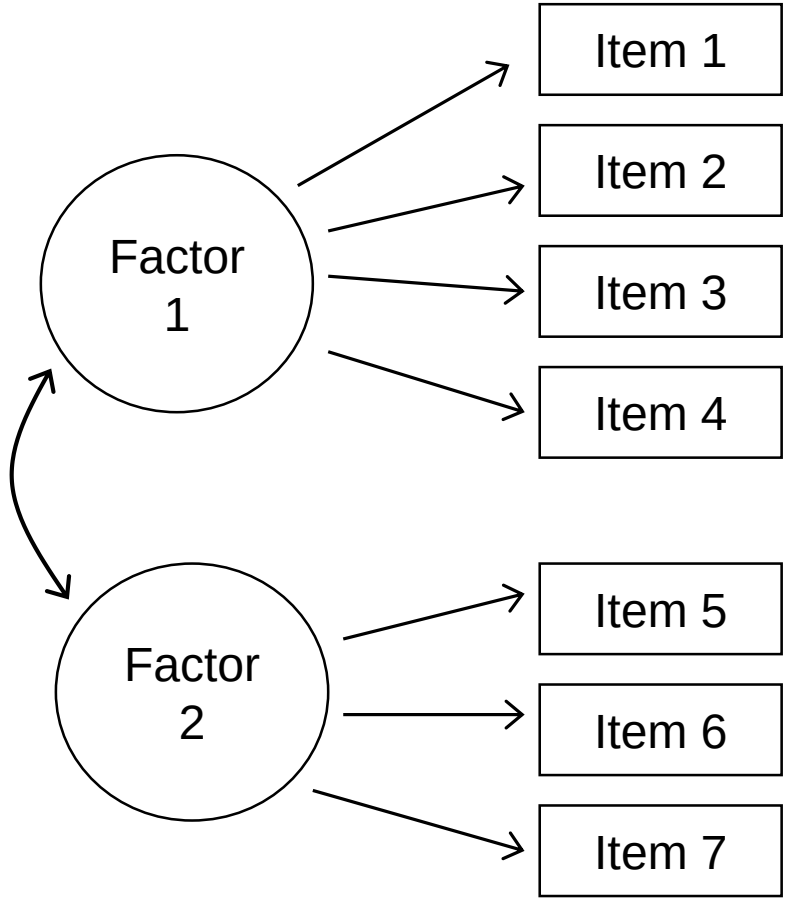

Goodness of Fit

- Recommended to use multiple different measures of fit
- Most indices only have rules of thumb (usually based on Hu and Bentler, 1999)
- CFI = ideally 0.95 or higher (same for NNFI), not below 0.90
- RMSEA = 0.05 or lower (upper bound < 0.08)

Goodness of fit estimates for initial models for GM@W and COPSOQ

	GM@W	COPSOQ	Rule of Thumb
Absolute Fit: Chi-square statistic	9153 (1937 df) $p < 0.001$	5022 (607 df), $p < 0.001$	$p > 0.05$
Standardised Root Mean Residual	0.049	0.051	< 0.08
Incremental Fit: Comparative Fit Index	0.841	0.941	0.95+
Non-Normed Fit Index	0.807	0.933	0.95+
Parsimony: RMSEA (upper limit)	0.064 (0.066)	0.046 (0.047)	< 0.05 (upper bound < 0.08)

Goodness of fit estimates for secondary* models for GM@W and COPSOQ

	GM@W	COPSOQ	Rule of Thumb
Absolute Fit: Chi-square statistic	8878 (1935 df) $p < 0.001$	4773 (605 df), $p < 0.001$	$p > 0.05$
Standardised Root Mean Residual	0.049	0.050	< 0.08
Incremental Fit: Comparative Fit Index	0.847	0.944	0.95+
Non-Normed Fit Index	0.812	0.937	0.95+
Parsimony: RMSEA (upper limit)	0.063 (0.065)	0.044 (0.046)	< 0.05 (upper bound < 0.08)

* Very minor tweaks to release non-significant variances, correlate errors within dimensions

Challenges to improve model fit

GM@W	COPSOQ
High correlations between items not in the same dimension. Lots of cross-loading between items and dimensions	High correlations between vertical trust and org justice (0.93). Lower but still high correlations between predictability and rewards (0.87) and quality of leadership and support from supervisors (0.86)
High correlations between dimensions. (18 of the 78 correlations between dimensions are 0.95 and higher)	Commitment to the workplace appears to be an outcome of other dimensions, rather than a separate dimension. Removing this dimension further improves model fit
More specific suggestions for improvements not possible at this stage	

Concluding Comments

GM@W measure of the psychosocial work environment

Poor model fit due to:

- Items not reflecting specific dimensions
- Proposed dimensions not being distinct from each other

- Recommend caution if using this measure to capture specific dimensions of the work environment, or to monitor change in specific dimensions over time.

Concluding Comments (2)

Copenhagen Psychosocial Questionnaire

- Second successful validation of the factor structure in a Canadian population
- Future analyses can examine potential French/English differences in model fit
- Questions remain about the ordering of the dimensions within the overall measure, and whether some dimensions influence others

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