Using tests for Differentiel Item Function and Differentiel Item Effect to Evaluate Construct Validity of the COPSOQ
Should we worry about

Cronbach’s alpha reliability?
Item total correlations?
Factor analyses?

In the COPSOQ

By and large: no, don’t worry

But we should worry about other things
Two Motivations for Scale Construction

**Effect Indicators**
- Felt sad
- Lacked self-confidence
- Felt guilty
- Lacked interest

**Causal Indicators**
- Keep eyes on lots of things
- Remember
- New ideas
- Difficult decisions

Item correlations
Factor analysis
Cronbach’s alpha

Bollen 1984
Bollen & Lennox 1991
Lee Cronbach on internal consistency

“Only if the underlying theory of the trait being measured calls for high item intercorrelations, do the correlations support construct validity.”

“High internal consistency may lower validity”

Cronbach and Meehl (1955)
## Example: Psychological Demands

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Alpha</th>
<th>Interitem correlations</th>
</tr>
</thead>
<tbody>
<tr>
<td>DWECs</td>
<td>3,552</td>
<td>0.55</td>
<td>0.11 – 0.40</td>
</tr>
<tr>
<td>COPSOQ II study</td>
<td>3,517</td>
<td>0.82</td>
<td></td>
</tr>
<tr>
<td>Knowledge workers</td>
<td>349</td>
<td>0.80</td>
<td>0.37 - 0.69</td>
</tr>
</tbody>
</table>
Test-retest reliabilities for the COPSOQ

Mutual trust between employees: ICC = 0.64

All other test-retest reliabilities had: ICC > 0.70

Examples:
Quantitative Demands: ICC = 0.87
Demands for hiding emotions: ICC = 0.75

Thorsen et al 2009 (accepted)
Other approaches to Construct Validity

Causal Indicator Scales are constructed because items are hypothesized to have a common effect

Keep eyes on lots of things
Difficult decisions
Remember
New ideas

Sick days

Differential Item Effect

Keep eyes
Difficult decisions
Remember
New ideas

Cognitive Demands

Sick days
Tests for DIF og DIE

Differential Item Functioning (DIF)  Differential Item Effect (DIE)

Age
- Logistic Models

Gender

Sector
- Logistic Model

Social Class
- Linear Models

Job Type
- Work Environment Scale

Logistic Model
- Burn-out
- Stress

Cox Model
- SRH
- Sick Days

Linear Model
- Depression
- Job Satisfaction
Control for spurious results due to multiple testing

- (Bonferroni correction or similar))
- Define DIF/DIE criteria based on magnitude of DIF/DIE
- Cross-validation
  - Split sample in two random halves
  - Perform tests in both halves
  - Accept only significant results that satisfy DIF/DIE criteria in both samples
Overall indications of DIF/DIE

All tests (1.052 tests)

- 452 significant in overall sample (600)
  - 310 significant with Bonferroni adjustment (282)
    - 8 DIF/DIE in sub-samples (67)
  - 223
    - 59
## DIF for Job Type

<table>
<thead>
<tr>
<th># DIF Items</th>
<th># Scales</th>
<th>Scales</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>16</td>
<td>Work Pace, Variation, Predictability, Recognition, Role Clarity, Role Conflicts, Quality of Leadership, Social Community at Work, Social Support Supervisor, Social Support Colleagues, Family-work Conflict, Stress (+somatic, + cognitive), Sleeping Troubles, Depression</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>Quantitative Demands, Hiding Emotions, Possibilities of Development, Meaning of Work, Job Satisfaction, Work-Family Conflict, Burn-out</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>Emotional Demands, Possibilities for Development</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>Cognitive Demands, Committment to the Workplace</td>
</tr>
</tbody>
</table>
DIF for the Burn-out item

How often have you been emotionally exhausted?
### DIE: Particularly ”good” items - 1

<table>
<thead>
<tr>
<th>Item</th>
<th>Low job satisfaction</th>
<th>Depressive symptoms</th>
<th>Burn-out</th>
<th>Stress</th>
<th>Poor General Health Perception</th>
<th>Risk of long-term sick leave</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you have enough time for your work tasks? (R)</td>
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<tr>
<td>Do you have to keep your eyes on lots of things while you work?</td>
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<tr>
<td>Does your work put you in emotionally disturbing situations?</td>
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<tr>
<td>Does your work require that you hide your feelings?</td>
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<tr>
<td>Do you have a large degree of influence concerning your work?</td>
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<td>Does your work give you the opportunity to develop your skills?</td>
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<tr>
<td>Is your work varied?</td>
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<tr>
<td>Do you have to do the same thing over and over again? (R)</td>
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</tbody>
</table>
## DIE: Particularly "good" items - 2

<table>
<thead>
<tr>
<th>Item</th>
<th>Low job satisfaction</th>
<th>Depressive symptoms</th>
<th>Burn-out</th>
<th>Stress</th>
<th>Poor General Health Perception</th>
<th>Risk of long-term sick leave</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you feel motivated and involved in your work?</td>
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<tr>
<td>How often do you consider looking for work elsewhere? (R)</td>
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<tr>
<td>Do you receive all the information you need in order to do your work well?</td>
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<tr>
<td>Are you treated fairly at your workplace?</td>
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<tr>
<td>How often is your nearest superior willing to listen to your problems at work?</td>
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<tr>
<td>How often are your colleagues willing to listen to your problems at work?</td>
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<tr>
<td>Are you worried about becoming unemployed?</td>
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<tr>
<td>Do you feel that your work drains so much of your energy that it has a negative effect on your private life?</td>
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</tbody>
</table>
## DIE: Particularly "poor" items

<table>
<thead>
<tr>
<th>Item</th>
<th>Low job satisfaction</th>
<th>Depressive symptoms</th>
<th>Burn-out</th>
<th>Stress</th>
<th>Poor General Health Perception</th>
<th>Risk of long-term sick leave</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you get behind with your work?</td>
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<td>Is it necessary to keep working at a high pace?</td>
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<td>Does your work demand that you are good at coming up with new ideas?</td>
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<tr>
<td>Do you have to relate to other people's personal problems as part of your work?</td>
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<td>Does your work require you to take the initiative?</td>
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<tr>
<td>Do you feel that the work you do is important?</td>
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<tr>
<td>Do you feel that your place of work is of great importance to you?</td>
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<tr>
<td>How often do you get help and support from your colleagues?</td>
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<tr>
<td>Do your friends or family tell you that you work too much?</td>
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</tbody>
</table>
What might be going on?

1. Core items (i.e. most central to the domain) works best
   - QD4, “enough time”
   - IN1, “influence concerning your work”
   - PD4, “opportunity to develop your skills”
   - JI1, “worried about becoming unemployed”

2. Ambiguous items works poorly
   - CW2, “place of work is of great importance to you?”
   - SC1, “help and support from colleagues”
What might be going on?

3. Items with outcome ‘flavour’ are good at predicting outcomes (tautology problem)
   • ED1, “Does your work put you in emotionally disturbing situations?” (outcome flavour)
   • ED2, “have to relate to other people’s personal problems as part of your work?” (no outcome flavour)

4. Heterogenous domains
   • CD1, “... have to keep your eyes on lots of things”
   • CD3, “…work demand that you are good at coming up with new ideas”
Conclusions

- Test-retest reliability studies showed higher reliabilities than Cronbach’s alpha reliabilities
- Rigorous testing using a conservative strategy identified 67 cases of DIF/DIE in 18 scales, most frequently for Job Type (DIF) and Job Satisfaction (DIE)
- A ”non-finding” does not prove lack of DIF/DIE
- ”Good” DIE items tended to be good across many different outcomes variables
- ”Poor” DIE items tended to be poor across many different outcomes variables
How can these results be used?

1. Better to refer to test-retest reliability studies than to calculate Cronbach’s alphas in each data set

2. Develop more efficient short-forms

3. Revise scales – free from the constraints of “internal consistency”

4. Consider using good items instead of scales when analysing current COPSOQ data