# Thursday AM

➤ Presentation of yesterday's results
➤ Factor analysis
➤ A conceptual introduction to:
  • Structural equation models
  • Multidimensional scaling

# Factor analysis

➤ Given responses to a set of items (e.g. 36 likert-scaled questions on a survey)…
➤ Try to extract a smaller number of *common latent factors* that can be combined additively to predict the responses to the items.
➤ Variance in response to an item is made up of:
  • Variance in common factors that contribute to the item
  • Variance specific to the item
  • Error

# Factor analysis: survey design

➤ Typically, a large set of likert-scaled items
➤ Design points:
  • 5 (or better, 7) response categories per item
  • 3-5 items per expected factor
  • 3-5 subjects per item
➤ Example: residency training survey data set
  • Likert scale with 7 categories per item
  • 41 items in 5 expected factors (3-16 per factor)
  • 234 subjects (nearly 6 subjects per item)

## Factor analysis: decisions

- *Exploratory* or *confirmatory* analysis?
- How will factors be *extracted*? (initial solution)
  - Principal components analysis
  - Maximum likelihood methods
- How will I choose *how many* factors to extract?
  - Based on theory
  - By scree plot
  - By eigenvalue

## Factor analysis: decisions

- How will factors be *rotated*? (rotated solution)
  - Orthogonal rotation (Varimax, etc.)
  - Oblique rotation (Promax, Oblimin, Quartimin)
- How should factors be *interpreted*?
  - Pattern matrix
  - High and low items

## Factor analysis in SPSS

- Analyze…Data reduction…Factor
- Enter items in Variables box
- Click "Extraction" and choose extraction method and how number of factors will be determined.
- Click "Rotation" and choose rotation method.
- Click "Scores" if you want to save factor scores
- Click "Options" and ask to have coefficients ("loadings") sorted by size and to have small coefficients suppressed.

## Use of factor scores

- Once factors are derived, *factor scores* can be computed for each subject on each factor
- Factor scores indicate how the subject perceives each of the factors.
- Factor scores can be used as variables in regression analyses (including path analyses).

## Factor analysis assignment

- Conduct factor analyses on the residency training data set and see what you can learn:
  - Vary some of the "decisions" and see how the results change.
  - If you find an interpretable solution, save the factor scores and see if they are related to any of the residency program demographics.

## Structural equation models

- Structural equation modeling is a technique that combines confirmatory factor analysis (the *measurement model*) and path analysis (the *structural model*) and does both at the same time.
- Requires specialized statistical software
  - Lisrel
  - EQS
  - Amos for SPSS

# Multidimensional scaling

➢ Given a set of similarity judgments between pairs of stimuli…

➢ Try to place the stimuli in a multidimensional psychological space such that distance between stimuli is proportional to dissimilarity.

➢ Often, try to place respondents in the same space, so that distance between respondents and stimuli is inversely proportional to preference.

➢ SPSS can do some kinds of MDS.