Factor Analysis

Revealing the correlational structure among variables

Understanding & Reducing Complexity

Some Uses of Factor Analysis

1. Understand association among constructs – structure of correlations (what are main dimensions that underlie the set of constructs?)

2. Scale construction (which test items go together? How many constructs are being measured?)

3. Data reduction (which variables can be combined together). For example, precursor to MANOVA

4. As part of Full Structural Equation Modeling / Latent Variable Analysis

Two forms of factor analysis

Exploratory

- Let the data indicate what's going on, with no (or little) expectations

Confirmatory

- Evaluate a specific, clearly-articulated hypotheses about a correlational structure among variables
- Get "fit" indices & significance tests

An intuitive overview of Exploratory Factor Analysis

Consider these eight personality attributes:

- Assertive
- Talkative
- Thoughtful
- Intellectual
- Dominant
- Influential
- Creative
- Imaginative

Is there redundancy?

Can we reduce these eight concepts to more basic dimensions?

An intuitive overview of Factor Analysis

1) Ask people to rate themselves on each term (How X are you on a 1 to 10 scale)?

2) Compute correlations among the terms. – Do people who score high on one attribute score high on the other?

Factor Analysis

Correlation Matrix

	Ass	Tlk	Dom	Inf	Cre	Ima	Tho	Int
Ass	1.00							
Tlk	.60	1.00						
Dom	.59	.78	1.00					
Inf	.47	.56	.46	1.00				
Cre	.00	.00	.00	.00	1.00			
Ima	.00	.00	.00	.00	.56	1.00		
Tho	.00	.00	.00	.00	.67	.39	1.00	
Int	.00	.00	.00	.00	.78	.45	.69	1.00

Factor Analysis

Step 3) Interpret the *pattern* of correlations – what is related to what?

Step 4) Identify clusters of items? "Factors"

Step 5) Psychologize – name the factors – what are the underlying dimensions?

Three Core Questions in Exploratory FA

1. Number of factors/dimensions
   - How many factors are there?
   - Do the variables have a one-factor correlational structure, two-factor, etc?
   - Eigenvalues, “scree” plot
   - Interpretability of factor meanings (see next question)

Three Core Questions in Exploratory FA

1. Number of factors/dimensions
2. What are the factors – psychological meaning?
   - The meaning of a factor emerges from the nature of the variables that "load" on it
   - Which vbls "load" most strongly on which factors?
   - Loadings (-1 to +1, more or less). More extreme = variable is more strongly associated with factor

Three Core Questions in Exploratory FA

1. Number of factors/dimensions
2. What are the factors – psychological meaning?
3. Factor-factor associations (if more than 1 factor)
    - Are the factors correlated with each other?
    - Are there “superfactors”?
    - The answer may depend on “rotation” method

Doing a "real" factor analysis: SPSS and Affect

Steps in the analysis

1. Are you doing a factor analysis or a principle components analysis?
   - "Extraction method"
   - Often there's little practical difference
2. Decide *how many* factors to examine (extract)
   - Again, based on "scree" plot, interpretability
3. Decide whether to "rotate" the factors (generally done)
   - Clarifies the results
   - Which type of rotation to use?
     - Orthogonal (eg Varimax) or Oblique (eg, Promax)
     - Implications for correlations among factors
4. Examine the rotated factor/component matrix
   - Interpret the factor loadings to interpret the meaning of the factors

NOTE – this is sometimes a back-and-forth process