Lab 7: Exploratory Factor Analysis

Lab Outline

• What is Exploratory Factor Analysis?
• Goal Orientation
• Exploratory Factor Analysis in a Real Dataset
• A Few Project Reminders

What is Exploratory Factor Analysis?

• Method to examine the dimensionality of a set of items.
• Technique can help identify groups of items in a scale that represent a common factor.
• Example: Extraversion includes facets such as Sociability and Assertiveness. Analyzing an Extraversion measure that adequately samples these different facets should result in the recovery of these facets.
General Steps of an Exploratory Factor Analysis

1. Collect Data on a Large Sample
2. Correlate the Items
3. Extract Factors
4. Examine Factor Coefficients
5. Label Factors

Inter-Item Correlation Matrix

Looking at inter-item correlations for a scale can give us some hints as to what items seem to be the most related.

<table>
<thead>
<tr>
<th>SEX1</th>
<th>SEX2</th>
<th>SEX3</th>
<th>SEX4</th>
<th>SEX5</th>
<th>SEX7</th>
<th>SEX8</th>
<th>SEX9</th>
<th>SEX10</th>
<th>sex6r</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.000</td>
<td>0.400</td>
<td>0.294</td>
<td>0.287</td>
<td>0.358</td>
<td>0.130</td>
<td>0.206</td>
<td>0.147</td>
<td>0.589</td>
<td>0.339</td>
</tr>
<tr>
<td>0.400</td>
<td>1.000</td>
<td>0.320</td>
<td>0.343</td>
<td>0.408</td>
<td>0.053</td>
<td>0.456</td>
<td>-0.174</td>
<td>0.391</td>
<td>0.375</td>
</tr>
<tr>
<td>0.294</td>
<td>0.320</td>
<td>1.000</td>
<td>0.527</td>
<td>0.587</td>
<td>0.047</td>
<td>0.288</td>
<td>0.162</td>
<td>0.289</td>
<td>0.563</td>
</tr>
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<td>0.343</td>
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<td>1.000</td>
<td>0.626</td>
<td>0.199</td>
<td>0.301</td>
<td>0.239</td>
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<td>0.034</td>
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</table>

The covariance matrix is calculated and used in the analysis.

How Do We Decide What is a Meaningful Factor?

- Scree Plot - Eigenvalues represent the variance that a factor explains (Want it to be over 1.0)
- Look at the pattern and decide how many are meaningful above 1.0
- How many factors seem to be meaningful in this case?
What do we do after determining what are meaningful factors?

- After meaningful factors are determined, we then run a “rotation” to help make the pattern more interpretable.
- For each item we get a “factor structure coefficient” which is interpreted as the correlation between the item (rows) and the latent factor (columns)
- As with normal correlations -- the higher the value, the stronger the association.

Let’s Work Through An Example

4-Dimensional Model of Goal Orientation

Goal Orientation
(Elliot & McGregor, 2001)

- How people focus attention while engaging in a task
- Traditional distinction: performance vs. mastery
- Performance: Demonstrate task competence to others
- Mastery: Development of competence through learning the task
- Now additional dimension examined: Approach vs Avoidance
4-Dimensional Model of Goal Orientation (Elliot & McGregor, 2001)

- **Performance-Approach**: Try to show task ability through high performance
- **Performance-Avoid**: Try to avoid showing low task ability
- **Mastery-Approach**: Try to learn as much as possible about a task
- **Mastery-Avoid**: Try to avoid showing a lack of learning in a task

**Elliot and McGregor Factors**

<table>
<thead>
<tr>
<th>Factors</th>
<th>Performance Approach</th>
<th>Performance Avoid</th>
<th>Mastery Approach</th>
<th>Mastery Avoid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I am determined to do my best no matter what the odds are.</td>
<td>92.1</td>
<td>4.2</td>
<td>91.4</td>
<td>4.5</td>
</tr>
<tr>
<td>2. I do my best to be as consistent as possible in my work.</td>
<td>84.3</td>
<td>5.7</td>
<td>83.6</td>
<td>5.4</td>
</tr>
<tr>
<td>3. I persist in the face of obstacles until I succeed.</td>
<td>76.8</td>
<td>7.2</td>
<td>76.0</td>
<td>7.4</td>
</tr>
<tr>
<td>4. I do the very best I can even though it may not be noticed.</td>
<td>80.0</td>
<td>6.0</td>
<td>79.4</td>
<td>6.6</td>
</tr>
<tr>
<td>5. I work hard even when I don't feel like it.</td>
<td>94.0</td>
<td>3.0</td>
<td>93.8</td>
<td>3.2</td>
</tr>
<tr>
<td>6. I try hard to do my best no matter what the odds are.</td>
<td>94.0</td>
<td>3.0</td>
<td>93.8</td>
<td>3.2</td>
</tr>
</tbody>
</table>

**Example Dataset**

- Included the Elliot and McGregor (2001) measure of Goal Orientation in previous surveys of 395 students
- Let's use SPSS to see if we find the same basic factors
Doing Exploratory Factor Analysis in SPSS

- Let's first look at the inter-item correlations for the Goal Orientation scale to see if the correlation pattern suggests that factors exist.
- Under Analyze
  - Scale, Reliability Analysis...
  - Select variables: EM1, EM2, EM3, EM4, EM5, EM6, EM7, EM8, EM9, EM10, EM11, EM12
  (This is the Goal Orientation measure)
  - Statistics: Inter-Item Correlations
  - Click OK

Doing Exploratory Factor Analysis in SPSS Continued

- The Actual Factor Analysis
- Under Analyze
  - Data Reduction, Factor...
  - Select variables: EM1, EM2, EM3, EM4, EM5, EM6, EM7, EM8, EM9, EM10, EM11, EM12
  (This is the Goal Orientation measure)
  - Extraction: Principle Axis Factoring, Number of Factors = 4
  - Rotation: Varimax (Forces factors to be uncorrelated)
  - Click OK

Our Exploratory Factor Analysis

- How does our class results compare to those of Elliot and McGregor?
- Do the items seem to load on the correct factors?
- Expected structure
  - Performance-Approach: Items 1-3
  - Master-Avoid: Items 4-6
  - Mastery-Approach: Items 7-9
  - Performance-Avoid: Items 10-12
Concerns with Factor Analysis?

- We get a number of clusters of items, but no general labels for the factors
- Researchers need to use their own judgment as to what the items loading on a factor “mean”
- Example: Big 5 Factor of Openness to Experience
  - Also known as Intellect and Culture
  - Naming factors is a judgment call
- Really want replicable factor solutions!

Important Dates

- By the Week of March 29 you should have a HARD COPY of the Introduction if you want feedback
- By the Week of April 12 you should have a HARD COPY of Method and Analysis section completed if you want feedback
- Absolutely due on May 7 by 9:45 am
- Papers turned in by the 9:10 am on the last day of lecture (29 April) will receive 10 Bonus Points

Formatting Your Papers Review

- Technical Details: Double‐spaced, 12 point Font, 1 inch margins.
- Main Text: 10‐12 pages text (10 pts off if paper is less than 10 pages or greater than 13 pages)
- Main text refers to the body of the paper. It does NOT include the References section, Cover page, and any Tables/Figures.
- If you have questions please ask your TA – you will lose points for formatting errors! (Such as using larger fonts or wider margins).
Homework for Lab 7 – Part 1

- Find the Elliot and McGregor (2001) article
  - Title: A 2 X 2 Achievement Goal Framework
  - Journal of Personality and Social Psychology
  - Volume 80, No. 3, pages 501-519
- Summarize the meaning of the four goal scales in your own words (1 point)
- Describe how they developed their scales (1 point)
- Summarize the nomological network for each of the goals (3 points)
- Objective: Learn more about the constructs!

Homework for Lab 7 – Part 2

- Make a Table that compares the item weights found by Elliot & McGregor with the weights found in the class data analysis. How are they similar and different (in terms of what loads together, how strongly, etc.) (2 points)?
- Calculate and report the reliabilities of each of the four goal orientation scales. Compare with original [Hint: Look at Slide 10 for the items in each scale] (1 point)
- Which scale has the highest reliability? The lowest? Compare with original (1 point)
- Calculate and report the means, standard deviations, and medians for each of the four goal orientation scales. Compare with original (1 point)