8.3: EFA Steps with Factor Extraction

Learning Objectives

At the end of this section you should be able to answer the following questions:

- What are the two types of rotation?
- What is the difference between a Covariance Matrix and a Correlation Matrix?

There are a number of decisions that need to be made before running the analysis. Some of which we will discuss in a second, some of which we will discuss as we go through the SPSS commands. A short list of decision points within EFA are: 1) generating a Matrix of Association, 2) Method of Extraction, and 3) Method of Rotation.

Matrix of Association

When generating a Matrix of Association this refers to a Covariance Matrix of your input items, or alternatively a Correlation Matrix of those items, which is a simple transformation of the Covariance Matrix. Some software programs will generate the matrix for you from raw data. Other programs may require you to enter the matrix in some way, such as pasting it into syntax.

Method of Extraction

Methods of extraction refer to means of estimating the variability explained by the input items by generating a parsimonious set of factors. There are several traditional methods of extraction of factors within EFA. There are many theoretical paper written about this, but for most purposes you will mainly be using the maximum likelihood method.

Rotation Methods

Rotation refers to changing the scaling of the factor data vectors (or sets of information corresponding to each factor) according to geometric axis – like an X-Y Cartesian Axis or a space of greater dimension such as a 3 dimensional axis space. There are two main categories of rotation options – or how to express the factors as vectors in a dimensional space (a very mathematical thing to say). These categories of rotation are *oblique rotation*, which allows for small-to-moderate correlation of factors, and *orthogonal rotation*, which assumes that the factors are uncorrelated. In psychology, it is very rare to find concepts that are unrelated to each other. For example, depression is often related to things like well-being, anxiety, or health. As such we generally want to use an oblique rotation choice, such as ProMax rotation.

Example

Now we will focus on our example: How many unique factors are there for items that examine social support in person and on Facebook?

We will be discussing analysis methods as we go, hopefully, this will inform you on the process of EFAs.

PowerPoint: Exploratory Factor Analysis Menu

Have a look at the below slides, which illustrate how to run an EFA:

- Chapter Eight – Exploratory Factor Analysis Menu

For this test, the statistical program used was Jamovi, which is freely available to use. We select the KMO and Bartlett's test of sphericity. The reason why we want to use these tests is to make sure that an EFA is useful with your data: if significant, it indicates that the data is appropriate for a factor analysis.

As seen in the tslide we want to choose ProMax, and the load plots to see how our items load on to factors. On the bottom right, we want to suppress lower factor values (which will be explained shortly).

Sampling Adequacy

To measure and judge if we have adequate sampling adequacy we have the results of the KMO and Bartlett tests, which tests if an EFA is useful with your data: if significant, it indicates that the data is appropriate for a factor analysis.

Communalities

The next we want to check in our EFA results is communalities. These indicate the proportion of common variance in an item, relative to all the factors. The method of figuring this out is the sum of squared factor loadings for that variable (e.g., item) across all the factors. This result keeps track of how much of the original variance that was contained in a particular variable is still accounted for by all retained factors.
