POLS 8505 Measurement Theory

12 January 2015

A. **Terminology** – **Basic Idea** – We are going to study **methods of representing a data matrix with points (vectors) in an Euclidean space.** The dimensions of the space are *latent dimensions*. In most cases we will be dealing with *relational* **data – that is, data that can be interpreted as distances**. We will also consider *singular value decomposition* in which any matrix can be decomposed into the product of three matrices – two orthogonal matrices and one diagonal matrix. SVD is fundamental to many scaling algorithms.

Coombsian Data Classification (Relational Data)

	Pairs of Points	**Pairs of Distances**
Points From Two Sets	II Single Stimulus	I Preferential Choice
Points From One Set	III Stimulus Comparison	IV Distance Comparison

1. **The Four Purposes of MDS (Borg & Groenen)**

    a. **An Exploratory Technique**

    b. **Testing Structural Hypotheses – Confirmatory (Weisberg)**

    c. **Exploring Psychological Structures**

d. A Model of Similarity Judgments

Table 1.1: Data Types and Appropriate Methods

Data Type	Example	Method	Chapter
Perceptual Data: Single Issue Scales	Individuals places themselves and/or parties on a liberal-conservative scale.	Maximum Likelihood and Bayesian Aldrich-McKelvey Scaling, Basic Space Scaling (`blackbox_transpose()`), and Anchoring Vignettes	Three
Perceptual or Preferential Data: Multiple Issue Scales	Survey respondents register their attitudes on a series of ordinal policy scales.	Basic Space Scaling (`blackbox()`) and Ordinal Item Response Theory (IRT)	Three, Seven
Perceptual or Preferential Data: Single Square Matrices of Similarity Ratings of Objects	An agreement score matrix is created that shows how often each legislator voted on the same side as every other legislator.	Metric, Non-metric and Bayesian Multidimensional Scaling (MDS)	Four
Perceptual or Preferential Data: Multiple Square Matrices of Similarity Ratings of Objects	Individuals or groups rate how similarly they view a series of political objects/stimuli (e.g., taxes and liberals).	Metric and Non-metric Individual Differences Scaling (INDSCAL)	Four
Preferential Data: Rectangular Matrices with Preferential Ratings using Interval Ratio-Level Scales	Individuals rate parties on a 0–100 scale or rank candidates from most to least preferred.	Least Squares and Bayesian Unfolding	Five
Preferential Data: Choices between Binary Alternatives	Legislators cast a series of roll call (Yea or Nay) votes.	Parametric Unfolding (NOMINATE and α-NOMINATE), Nonparametric Unfolding (Optimal Classification) and Bayesian IRT	Six