

Analyzing Survey Research Data

2020 GSERM

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Course Description

This course is aimed at aiding scientists in better measuring the phenomena they are interested in. Though scientists of all sorts recognize measurement as a fundamental and crucial step of the scientific process, the topic is rarely given formal attention in core graduate courses beyond a cursory treatment of the concepts of reliability and validity.

We will begin by discussing a theory of data that can be used to aid researchers in determining the most appropriate and useful scaling methodologies to apply to their data. From here, we will engage psychometric philosophies of measurement, which will eventually introduce students to basic unidimensional scaling models. The assessment, and ultimate reduction, of dimensionality via principal components and factor analysis will round out the second core section of the course. Finally, we will consider a host of methodologies useful for representing substantively interesting characteristics of data in multiple dimensions, and, in particular, providing spatial, or geometric, visualizations of those characteristics. These methodologies include classical multidimensional scaling, multidimensional preference scaling, and correspondence analysis.

Course Prerequisites & Software Considerations

Students should be familiar, and comfortable, with basic descriptive statistics and linear models (i.e., OLS regression). Familiarity with matrix algebra and maximum likelihood estimation will serve students well, but is not required for participation or necessary for students to understand course material.

Most software programs include routines for executing most of the techniques we will discuss in class, though none is perfect. In an effort to keep the focus of course on the substantive material, code to execute most methodologies in the R statistical computing environment will be made available to students. I am happy to work with students who are most familiar with Stata or SPSS outside of class.

Course Materials

There is no required textbook for this course. This is partially because much of the material we will be exploring can be learned from more accessible (i.e., free!) journal articles. The

class schedule below provides a lengthy list of such articles, organized by topic. The lack of a textbook is at least equally due to the fact that there really is no single text that addresses all of the topics we will be considering, at least not in the way we will be covering them.

Those caveats aside, there are a few excellent textbooks that cover several of the topics we will be addressing. In order of utility to this course, by my estimation, starting with most useful:

The Wiley Handbook of Psychometric Testing, 2 Volume Set: A Multidisciplinary Reference on Survey, Scale and Test Development. 2018. Eds. Paul Irwing, Tom Booth, and David J. Hughes. Wiley-Blackwell.

Bartholomew, David J., Fiona Steele, Iirini Moustaki, and Jane I. Galbraith. 2008. *Analysis of Multivariate Social Science Data (Second Edition)*. Chapman and Hall/CRC Press.

Some less comprehensive texts that pop up over the course of at least a couple of topics are:

Borg, Ingwer and Patrick Groenen. 2005. *Modern Multidimensional Scaling: Theory and Applications (Second Edition)*. Springer.

Jacoby, William G. 1991. *Data Theory and Dimensional Analysis*. Sage.

McIver, John and Edward G. Carmines. 1981. *Unidimensional Scaling*. Sage.

Texts that may help in conducting analyses in R:

Armstrong II, David A., Ryan Bakker, Royce Carroll, Christopher Hare, Keith T. Poole, and Howard Rosenthal. 2014. *Analyzing Spatial Models of Choice and Judgment with R*. Chapman and Hall/CRC Press.

Mair, Patrick. 2018. *Modern Psychometrics with R*. Springer.

Everitt, Brian and Torsten Hothorn. 2011. *An Introduction to Applied Multivariate Analysis with R*. Springer.

Course Requirements

Though the Global School in Empirical Research Methods is most concerned with providing students with the practical tools necessary to aid their own research, formal evaluations of course performance will be made at the end of the session. After the course has ended, students will have two weeks to complete a comprehensive assignment where they will be asked to employ several of the methodologies covered in class.

Class Schedule

Day 1: Data Theory, Measurement, & Summated Rating Scale

- *The Wiley Handbook of Psychometric Testing*. 2018. Chapter 28.
- Stevens, S. S. 1946. "On the Theory of Scales of Measurement." *Science* 103:677-680.
- Jacoby, William G. 1999. "Levels of Measurement and Political Research: An Optimistic View." *American Journal of Political Science* 43: 271-301.
- Young, Forrest W. 1981. "Quantitative Analysis of Qualitative Data." *Psychometrika* 46: 357-388.
- Spector, Paul E. 1992. *Summated Rating Scale Construction*. New York: Sage.

Day 2: Reliability & Cumulative Scaling

- *The Wiley Handbook of Psychometric Testing*. 2018. Chapters 2 & 23.
- Sijtsma, Klaas. 2009. "On the Use, Misuse, and the Very Limited Usefulness of Cronbach's Alpha." *Psychometrika* 74: 107-120.
- Traub, Ross E. 1997. "Classical Test Theory in Historical Perspective." *Educational Measures: Issues and Practice* Winter 1997: 9-14.
- McIver and Carmines. 1981. Chapters 3-6.
- Jacoby. 1991. Pages 38-41.
- van Schuur, Wijbrandt H. 2011. *Ordinal Item Response Theory: Mokken Scale Analysis*. Sage.
- van der Ark, L. Andries. 2007. "Mokken Scale Analysis in R." *Journal of Statistical Software* 20(11).

Day 3: SVD, Biplots, & Principal Components Analysis

- *The Wiley Handbook of Psychometric Testing*. 2018. Chapters 8 & 10.
- Mair. 2018. Chapters 2, 6, & 10.
- Greenacre, Michael. 2012. "Biplots: The Joy of the Singular Value Decomposition." *Wiley Interdisciplinary Reviews: Computational Statistics* 4: 399-406.

- Bartholomew et al. 2008. Chapters 5 & 7.
- Dunteman, George H. 1989. *Principal Components Analysis*. Sage.
- Henson, Robin K., and J. Kyle Roberts. 2006. “Use of Exploratory Factor Analysis in Published Research: Common Errors and Some Comment on Improved Practice.” *Educational and Psychological Measurement* 66: 393-416.

Day 4: Factor Analysis & Multidimensional Scaling

- *The Wiley Handbook of Psychometric Testing*. 2018. Chapters 8 & 10.
- Mair. 2018. Chapters 2, 6, & 10.
- Greenacre, Michael. 2012. “Biplots: The Joy of the Singular Value Decomposition.” *Wiley Interdisciplinary Reviews: Computational Statistics* 4: 399-406.
- Bartholomew et al. 2008. Chapters 5 & 7.
- Dunteman, George H. 1989. *Principal Components Analysis*. Sage.
- Henson, Robin K., and J. Kyle Roberts. 2006. “Use of Exploratory Factor Analysis in Published Research: Common Errors and Some Comment on Improved Practice.” *Educational and Psychological Measurement* 66: 393-416.
- *The Wiley Handbook of Psychometric Testing*. 2018. Chapter 14.
- Kruskal, Joseph B. and Myron Wish. 1978. *Multidimensional Scaling*. Sage.

Day 5: More Multidimensional Scaling & Correspondence Analysis

- Borg and Groenen. 2005. Chapters 2-4, 9, 11, & 13.
- Armstrong II et al. 2014. Pages 103-128, 132-143, & Chapter 5.
- Bartholomew et al. 2008. Chapters 3 & 4.
- Mair. 2018. Chapters 7 & 9.
- Greenacre, Michael. 2016. *Correspondence Analysis in Practice*. Chapman and Hall/CRC Press.