

Course Syllabus (AKA the Action Plan)

Psychology 509: Psychological Scaling—Multidimensional Methods
Spring, 2013

Psychology Building, Room 815
Tuesday/Thursday, 2-4
(Open Lab: 219a, Wednesday, 4-5)

Instructor:

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433 Psychology

Office hours: Wednesday, 1-3

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I have put some class material up on our website:

http://cda.psych.uiuc.edu/mds_509_2013

Make sure you have a flash-drive (with at least 1 GB) that you can dedicate to this class—for downloads; papers; programs; etc.

Various MDS books are in 434 for reading (in the room); also, there exists a large pile of papers that cover many different aspects of MDS.

More substantively oriented topics for your “googling” pleasure: use “multidimensional scaling” plus your favorite journal name (e.g., neuroimage) — or, possibly with: cancer; medicine; anthropology; archaeology; public health; cross cultural; human factors; social network; information science; library science; personality psychology; social psychology; developmental psychology; sexual psychology; clinical psychology; vocational psychology; counseling psychology; biological psychology; cognitive psychology; marketing; gay lesbian; hiv; music; fmri; vision; auditory; taste; smell; tactile; pain; facial expression; emotions; face recognition; neuroscience; social work

More quantitatively oriented topics —

Multidimensional scaling in other geometries — Riemannian space: Henry Pieszko, Multidimensional scaling in Riemannian space, *Journal of Mathematical Psychology*, 1975, 12, 449-477.

T. F. Cox and M. A. A. Cox, Multidimensional scaling on a sphere, *Communications in Statistics*, 1991, 20, 2943-2953.

Multidimensional scaling and social network analysis:

Ronald Breiger, Scott Boorman, and Phipps Arabie, An algorithm for clustering relational data with applications to social network analysis and comparison with multidimensional scaling, *Journal of Mathematical Psychology*, 1975, 12, 328-383.

Rich Dejordy, Stephen P. Borgatti, Chris Roussin, and Daniel Haggin, Visualizing proximity data, *Field Methods*, 2007, 19, 239-263.

Seriation, interval graphs, and so on:

Michael Hahsler, Kurt Hornik, and Christian Buchta, Getting things in order: An introduction to the R package “seriation”

Also, Chapter 4 in my yellow monograph (object sequencing and seriation)

Leland Wilkinson and Michael Friendly, The history of the cluster heat map (this appeared in the American Statistician; available on our website)

Multidimensional scaling and location theory:

Lawrence Hubert and Patricia Busk, Normative location theory: Placement in continuous space, Journal of Mathematical Psychology, 1976, 14, 187-210.

Clustering methods based on least-squares (to embed into scaling representations): My cluster analysis toolbox

A CLUE for CLUster Ensembles (for R by Kurt Hornik)

Bidimensional regression (Procrustes problems): The monograph by Gower and Dijksterhuis (Procrustes Problems)

Alinda Friedman and Bernd Kohler, Bidimensional regression: Assessing the configural similarity and accuracy of cognitive maps and other two-dimensional data sets, Psychological Methods, 2003, 8, 468-491.

Numerical geometry of non-rigid shapes: Monograph by Bronstein, Bronstein, and Kimmel

Use of PROC MDS in SAS (a successor to ALSCAL)

Use of newMDSX (Tony Coxon)

Use of ANTHROPAC (Social Network Analysis) and UICINET

Use of Cox and Cox provided programs

Use of NTSYSpc (from James Rohlf)

Multidimensional scaling using asymmetric proximity measures: Joseph Rodgers and Tony Thompson, Seriation and multidimensional scaling: A data analysis approach to scaling asymmetric proximity matrices, *Applied Psychological Measurement*, 1992, 16, 105-117.

Wayne DeSarbo and Ajay Manrai, A new multidimensional scaling methodology for the analysis of asymmetric proximity data in marketing research, *Marketing Science*, 1992, 11, 1-20.

Multidimensional scaling and strengthening the monotonic transformation:

My Unidimensional and Bidimensional Scaling Toolbox

James Ramsey, Monotone regression splines in action, *Statistical Science*, 3, 1988, 425-461.

Roger Shepard, Representation of structure in similarity data: Problems and prospects, *Psychometrika*, 1974, 39, 373-421.

Classical Multidimensional Scaling:

Guttman versus Torgerson; dimensionality estimation; Laplacian matrix

Kenneth Hall, An r-dimensional quadratic placement algorithm, *Management Science*, 1970, 17, 219-229.

Multidimensional scaling and flattening nonconvex polyhedral surfaces and related topics:

Eric Schwartz, Allan Shaw, and Estarose Wolfson, A numerical solution to the generalized mapmaker's problem: Flattening nonconvex polyhedral surfaces, *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 1989, 11, 1005-1008.

Gil Zigelman, Ron Kimmel, and Nahum Kiryati, Texture mapping using surface flattening via multidimensional scaling, *IEEE Transactions on Visualization and Computer Graphics*, 2002, 8, 198-207.

D. E. Welchew, G. D. Honey, T. Sharman, T. W. Robbins, and E. T. Bullmore, Multidimensional Scaling of Integrated Neurocognitive Function and Schizophrenia as a Disconnection Disorder, *Neuroimage*, 2002, 17, 1227-1239.

E. Bigand, S. Vieillard, F. Madurell, J. Marozeau, A. Dacquet, Multidimensional scaling of emotional responses to music: The effect of musical expertise and of the duration of the excerpts, *Cognition and Emotion*, 2005, 19, 1113-1139.

A more data collection oriented topic — a good exemplar to follow (we will read this one in class):

Julie Irwin, Lawrence Jones, and David Mundo, Risk perception and victim perception: The judgment of HIV cases, *Journal of Behavioral Decision Making*, 1996, 9, 1-22.

Computational How-to-dos —

We will cover these:

Matlab/Roll your own

Torgerson

Guttman

Matlab/Statistics Toolbox

nonmetric MDS

metric MDS

Martinez/Martinez M-file, nmmnds.m, from their EDA volume

Matlab/My Toolboxes

metric/nonmetric

one-mode/two-mode

multiple matrices/single matrix

city-block representation emphasis

R/traditional

isoMDS

metric MDS

Sammon mapping

R/smacof

SYSTAT

Does it all

SPSS

PROXSCAL

PREFSCAL

We will not cover these explicitly:

ANTHROPAC and UICINET

SAS

Proc MDS

newMDSX

Cox and Cox provided programs

NTSYSpc

Items we will do in class:

Roger Shepard, Multidimensional scaling, tree-fitting, and clustering, *Science*, 1980, 210, 390-398.

Louise Fitzgerald and Lawrence Hubert, Multidimensional scaling: Some possibilities for counseling psychology, *Journal of Counseling Psychology*, 1987, 34, 469-480.

Leland Wilkinson, Multidimensional scaling (Chapter from the SYSTAT manual).

Jan de Leeuw, Multidimensional scaling (short review article from some encyclopedia).

Front matter from Ingwer Borg and Patrick Groenen, *Modern Multidimensional Scaling (Second Edition)* — a pdf of the whole book is available from our library (and from our website)

James Rounds and Michael Zevon, Multidimensional scaling research in vocational psychology, *Applied Psychological Measurement*, 1983, 7, 491-510.

Lawrence Jones, Multidimensional models of social perception, cognition, and behavior, *Applied Psychological Measurement*, 1983, 7, 451-472.

Lee Cooper, A review of multidimensional scaling in marketing research, *Applied Psychological Measurement*, 1983, 7, 427-450.

Edward Shoben, Applications of multidimensional scaling in cognitive psychology, *Applied Psychological Measurement*, 1983, 7, 427-450.

Julie Irwin, Lawrence Jones, and David Mundo, Risk perception and victim perception: The judgment of HIV cases, *Journal of Behavioral Decision Making*, 1996, 9, 1-22.

Phipps Arabie and Carman Maschmeyer, Some current models for the perception and judgment of risk, *Organizational Behavior and Human Decision Processes*, 1988, 41, 300-329.

Gail Gliner, Susan Goldman, and Lawrence Hubert, A methodological study on the evaluation of learning from story narratives, *Multivariate Behavioral Research*, 1983, 18, 9-36.

J. Douglas Carroll and Paul Green, Psychometric methods in marketing research: Part II, Multidimensional scaling, *Journal of Marketing Research*, 1997, 34, 193-204.

Manuals for SPSS Proxscal and Prefscal

Permap Manual

Multidimensional Scaling Using Majorization: SMACOF in R (from the *Journal of Statistical Software*) The smacof Package (for R)

SYSTAT module on Perceptual Mapping

Chapter 3, Dimensionality Reduction - Nonlinear Methods, from
Martinez/Martinez, Exploratory data analysis with MATLAB

Various documentation sources for Multidimensional Scaling in
MATLAB and/or R

My Toolboxes:

(Uni- and Bi-)dimensional) Scaling: A Toolbox for MATLAB

The Structural Representation of Proximity Matrices with MAT-
LAB (published SIAM Monograph)

If time permits, we could do

Annual Review of Psychology Articles:

Robert Nosofsky, Similarity scaling and cognitive process models, ARP, 1992, 43, 25-53.

Phipps Arabie and Lawrence Hubert, Combinatorial data analysis, ARP, 1992, 43, 169-203.

Forrest Young, Scaling, ARP, 35, 55-81.

J. Douglas Carroll and Phipps Arabie, Multidimensional scaling, ARP, 1980, 31, 607-649.

J. Douglas Carroll and Phipps Arabie, Multidimensional scaling, in Birnbaum's, Measurement, Judgement, and Decision Making, 1998, 179-250.

Seriation:

Michael Hahsler, Kurt Hornik, and Christian Buchta, Getting things in order: An introduction to the R package seriation. (JSS, March 2008).

Combinatorial data analysis: Optimization by dynamic programming (published SIAM monograph)

Social Network Analysis: The online (free) text from Hanneman and Riddle

Dates:

January 31 (Thursday): A short paragraph on what project you will tackle for this class.

February 28 (Thursday): A thorough bibliography you will be using for your class presentation and the final written paper.

March 26 (Tuesday): Your printed set of slides (hopefully from a pdf source) that you will use for your hour-long class presentation sometime in April.

May 1 (Tuesday, last class): your completed final paper on the project for this class.

We have twelve class periods at the end of March and in all of April that could be used for presentations. We could do two such presentations in a two-hour class period. Think about when you might do this; we will set up a schedule toward the end of March.

January

15 Introduction

17 Shepard; Fitzgerald-Hubert

22 MDS SYSTAT

24 de Leeuw; Borg-Groenen contents

29 Shoben; Cooper

31 Jones; Rounds-Zevon

February

5 Irwin-Jones-Mundo; Arabie-Maschmeyer

7 Gliner-Goldman-Hubert; Carroll-Green

12 SPSS Proxscal and Prefscal

14 SMACOF in R; Traditional scaling in R

19 Permap; Perceptual Mapping from SYSTAT

21 MATLAB; Martinez-Martinez Chapter 3

26 My Unidimensional (and Bidimensional) Scaling Toolbox for Matlab

28 Continued from February 26th

March

5 Structural Representation of Proximity Matrices

7 Continued from March 5th

12 Continued from March 7th

14 Review of and scheduling of what will be presented from now on; Decisions about what else we will do from the “time permits” grouping given above.

March

26 –

28 –

April

2 – 4 –

9 – 11 –

16 – 18 –

23 – 25 –

30 –

May

1 Last class; closing time and wrap-up