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:
Lawrence Hubert
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:


Multidimensional scaling and social network analysis:


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:

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:


Multidimensional scaling and strengthening the monotonic transformation:
My Unidimensional and Bidimensional Scaling Toolbox

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
Multidimensional scaling and flattening nonconvex polyhedral surfaces and related topics:


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


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, nmmds.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:

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).


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.


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 MATLAB (published SIAM Monograph)
If time permits, we could do

Annual Review of Psychology Articles:

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

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


Seriation:

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
There appears to be general agreement among social psychologists that most human behavior is goal-directed (e.g., Heider, 1958; Lewin, 1951). To be sure, a certain sequence of actions can become so habitual or routine that it is performed almost automatically, as in the case of driving from home to work or playing the piano. Highly developed skills of this kind typically no longer require conscious formulation of a behavioral plan. Nevertheless, at least in general outline, we are normally well aware of the actions required to attain a certain goal. Consider such a relatively routine behavior as typing a letter.