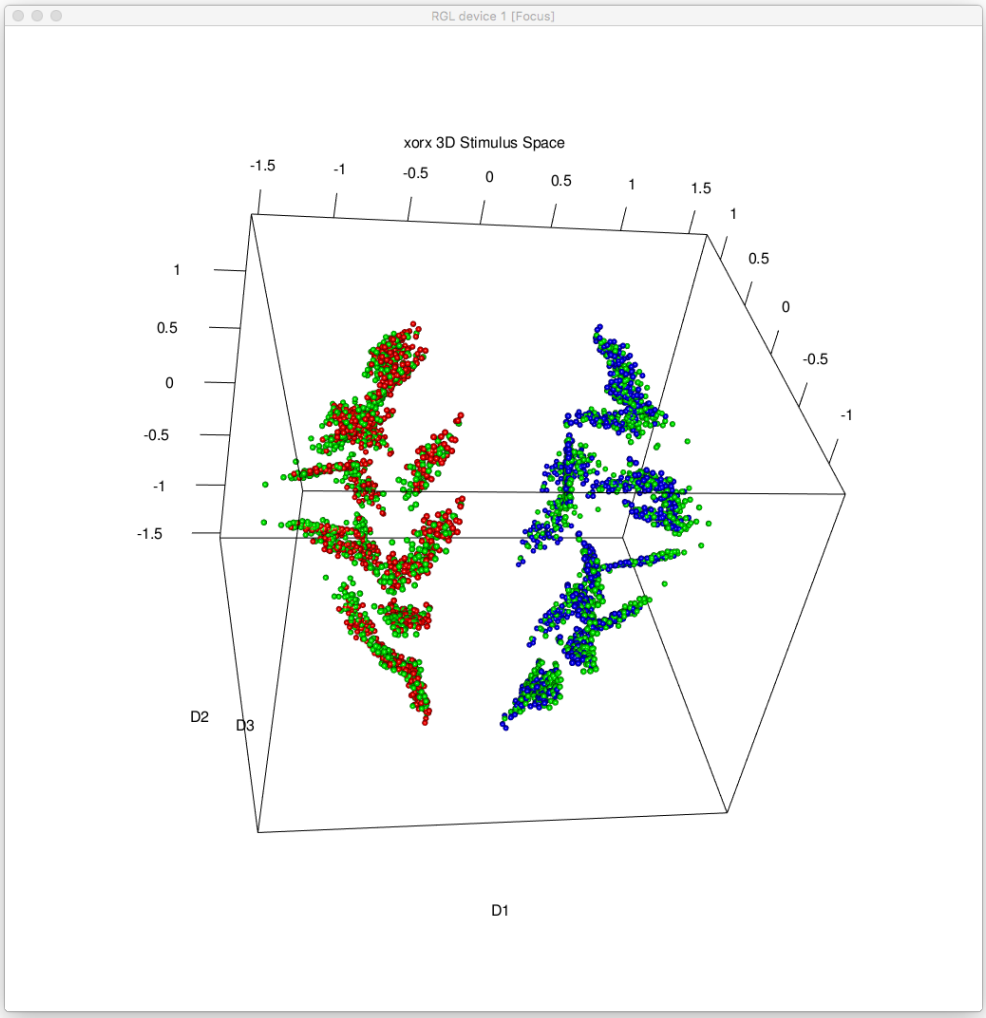
Applied Multidimensional Scaling

PSYC 4541–003

Spring 2016, Tuesday and Thursday, 9:30–10:45
Muenzinger E311

Lewis O. Harvey, Jr. – Instructor



3.Mar.2016

This Page Blank (except, of course, for these words and the header and the footer)

Applied Multidimensional Scaling

In this course you will learn how to apply the powerful techniques of multidimensional scaling to psychological data. You will learn how to use the smacof package (Mair, de Leeuw, & Groenen, 2015) in the open source R Project for Statistical Computing software for carrying out these analyses. You will read original journal articles and analyze data sets of others and of your own. The precise type of psychological data we examine will depend on the interests of the students in the class.

The syllabus and other files below are in Adobe Portable Document Format (pdf). Double-click on each active link to read the file. Mac users can use Preview, a pdf reader that is included with the OS X operating system. Windows users can download the free Adobe Reader from Adobe to read pdf files. Check out the course Desire2Learn: https://learn.colorado.edu. You will need your IdentiKey user name and password to access the course page and to download the pdf files of the journal articles.
The course is divided roughly into three parts:

1. Background reading and in-class presentations of scientific articles

2. Introduction of new student-generated reading and the formulation of testable hypotheses

3. Design and execution of experiments that test the hypotheses. Students will make presentations of their research findings both in class and at the Spring Undergraduate Research Day (27 April 2016)

Course participants are expected to participate at a high level and engage in sparkling intellectual interactions with me and the other participants in the class. The two main goals of the course are to learn something and to have fun.

Office Hours

Name	Lewis O. Harvey, Jr.
Office	MUEN D251b
Hours	9:00–10:00 Monday & Friday
	11:00–12:00 Wednesday
	and by appointment
Telephone	303-492-8882
email	lewis.harvey@colorado.edu
web	http://psych.colorado.edu/~lharvey/

Syllabus Topics and Reading Assignments

1.	12 Jan	Introduction	BGM 1
1.	14 Jan	The Purpose of MDS	BGM 2
2.	19 Jan	R in all its glory	BGM 2
2.	21 Jan	SMACOF	BGM 2
3.	26 Jan	Goodness of Fit	BGM 3
3.	28 Jan	Goodness of Fit	BGM 3
4.	2 Feb	Proximities as Data	BGM 4
4.	4 Feb	Preferences as Data	BGM 4
5.	9 Feb	MDS Models	BGM 5
5.	11 Feb	MDS Models	BGM 5
6.	16 Feb	Confirmatory MDS	BGM 6
6.	18 Feb	Confirmatory MDS	BGM 6
7.	23 Feb	Critical Mistakes	BGM 7
7.	25 Feb	Critical Mistakes	BGM 7
8.	1 Mar	Readings	
8.	3 Mar	Readings	
9.	8 Mar	Readings	
9.	10 Mar	Readings	
10.	15 Mar	Readings	
10.	17 Mar	Readings	
11.	22 Mar	**Spring Break**	
11.	24 Mar	**Spring Break**	
12.	29 Mar	Hypothesis Testing	
12.	31 Mar	Hypothesis Testing	
13.	5 Apr	Hypothesis Testing	
13.	7 Apr	Hypothesis Testing	
14.	12 Apr	Hypothesis Testing	
14.	14 Apr	Hypothesis Testing	
15.	19 Apr	Data Analyses	
15.	21 Apr	Data Analyses	
16.	26 Apr	Data Analyses	
16.	27 **Apr**	**Undergraduate Research Day** **15:00–17:00, UMC Glenn Miller**	
16.	28 Apr	Final Class Meeting (FCQ)	
	2 May	**Final Exam** **Monday (16:30–19:00)**	

Textbook

Borg, I., Groenen, P. J. F., & Mair, P. (2013). *Applied multidimensional scaling*. Heidelberg ; London: Springer.

The BGM numbers following each topic above refer to chapters in the textbook (Borg, Groenen, & Mair, 2013). Please read the corresponding chapters before coming to class.

Readings

1.	12 Jan 2016	BGM 1		
	14 Jan 2016	BGM 2		
2.	19 Jan 2016	BGM 2		
	21 Jan 2016	BGM 2		
3.	26 Jan 2016	BGM 3		
	28 Jan 2016	BGM 3		
4.	2 Feb 2016	BGM 4		
	4 Feb 2016	BGM 4		
5.	9 Feb 2016	BGM 5		
	11 Feb 2016	BGM 5		
6.	16 Feb 2016	BGM 6		
	18 Feb 2016	BGM 6	(Janal, Clark, & Carroll, 1991)	David Alpert
7.	23 Feb 2016	BGM 7	(Rather & Goldman, 1994)	David Messinger
			(Cha, Kim, & Lee, 2009)	Essie Quevedo
	25 Feb 2016	BGM 7	(Casasanto, 2008; Segerstrom, Stanton, Alden, & Shortridge, 2003)	Michelle Ferris
			(Bimler & Kirkland, 2001)	Yale Mitchell
8.	1 Mar 2016		(Robinson & Bennett, 1995)	Emma Wilmore
	3 Mar 2016		(Blumenthal, 2007)	Sarah James
9.	8 Mar 2016		(Sumiyoshi, Sumiyoshi, Roy, Jayathilake, & Meltzer, 2006)	Allegra Lyon
			(Linkovich-Kyle & Dunn, 2001)	Vince Mathias
	10 Mar 2016			
10.	15 Mar 2016			
	17 Mar 2016			
11.	**22 Mar 2016**	**Spring Break**		
	24 Mar 2016	**Spring Break**		
12.	29 Mar 2016			
	31 Mar 2016			
13.	5 Apr 2016			
	7 Apr 2016			
14.	12 Apr 2016			
	14 Apr 2016			
15.	19 Apr 2016			
	21 Apr 2016			
16.	26 Apr 2016			
	27 Apr 2016	**Undergraduate Research Day, 15:00–17:00, UMC Glenn Miller Ballroom**		
	28 Apr 2016	**Final Class Meeting (FCQ)**		

Copies of these papers are available to download for reading through D2L using your CU IdentiKey ID. See the reference section at the end of the syllabus for complete citation information.

Conditions Under Which The Course Operates

Class Meetings:
The class meetings will be highly interactive. Each student will make a minimum of two presentations of an original research article to the rest of the class. The whole class will evaluate the presentation and I will provide each student with feedback. Each presentation will be worth 50 points.

Additional Readings:
There are *n* original journal papers that are assigned for the course. Each student is expected to research a topic, provide one paper for the whole class to read and then make a presentation on the paper to the class.. The quality of the resulting presentation to the class will be worth 50 points

Hypotheses:
As the semester progresses we will accumulate a list of testable hypotheses that will form the basis for the experiments that we will do. As part of each reading, you will formulate at least one testable hypothesis.

Hypotheses Testing:
We will form teams of 3-5 students. Each team will design and carry out a simple experiment to test one of the hypotheses that have been generated from the reading. The experiments will be executed on computers using available software tools. You do not have to be a computer programmer!!!! I will help you implement your experiments and carry out any statistical analyses.

Final Results:
Each team will prepare a poster presentation for the Undergraduate Research Day, held on Wednesday, 27 April 2016, from 15:00–17:00, in the UMC Glenn Miller Ballroom. The quality of the poster will rate a maximum of 50 points. During the last week of classes, each group will give a 15 minute presentation of their results using PowerPoint or KeyNote to the rest of the class. The Quality of this presentation is worth 50 points. Finally each group will prepare a written summary of their experiment with Introduction, Methods, Results, Discussion, and Reference sections. This written paper is worth 50 points.

Grading:
Your final grade is computed from your points as described above. The total possible points in the course is 250:

50	In-Class Presentation
50	Poster Presentation
50	PowerPoint Presentation
50	Written Description of Experiment
50	Enthusiasm

250	Total Possible Points

Your final letter grade in the course will be assigned in the following manner. First a "Reference Score" will be calculated by taking the mean of the top two people in the class. Your grade will be determined by how well you have done in comparison to this reference score:

	A >96.6%,	A- >93.3% of the reference score
B+ >90.0%,	B >86.6%,	B- >83.3% of the reference score
C+ >80.0%,	C >76.6%,	C- >73.3% of the reference score
D+ >70.0%,	D >66.6%,	D- >63.3% of the reference score
	F <63.3%	

It is therefore possible for the entire class to receive the grade of A. By the same token, it is also possible that very few people would receive an A, depending on the spread of grades across the class.

Comments About Applied Multidimensional Scaling

Why Take This Course?
There are four reasons to take this course:

1. To gain an understanding of multidimensional scaling;
2. To sharpen your ability to critically evaluate the results of published experiments;
3. To learn how to analyze psychological data using MDS methods;
4. Have fun during your last semester at CU.

Prerequisites:
A broad understanding of the basic concepts from a general psychology course is assumed. You will be using methods of inferential statistics, such as those taught in Psychology 2101/3101, to evaluate the results of your experiment. A facile ability with these methods in particular will be necessary. **I am here to help you.**

You will be expected to write in a clear and grammatically correct style in this class. If you believe you will require extra help with your writing, please visit The Writing Center located in Norlin Commons (Norlin E111). More information can be found at: http://www.colorado.edu/pwr/writingcenter.html. You can also reach The Writing Center help desk by phone at (303) 735-6906.

AGREEMENTS FOR PARTICIPATING IN THE COURSE

The purpose of these agreements is to create a condition that allows all people in the class to get maximum value from the course.

AGREEMENTS

1 You agree to be responsible for these agreements.

2 You agree to be on time to class

3 You agree to complete the assigned reading on time.

4 You agree to complete your presentation assignments on time.

5 You agree to attend all class meetings unless an emergency comes up.

6 You agree to understand the material.

7 You agree to ask questions when you don't understand the material.

8 You agree to communicate any complaints and criticisms you may have only to someone who can do something about the situation and you agree not to complain or to criticize to someone who cannot do something about the situation.

9 You agree to get value out of your participation in the course.

If you attend the next class meeting, you are accepting responsibility for the above agreements.

Academic Integrity Policy

A university's intellectual reputation depends on maintaining the highest standards of intellectual honesty. Commitment to those standards is a responsibility of every student, faculty, and staff member on the University of Colorado at Boulder campus.

A university's intellectual reputation depends on maintaining the highest standards of intellectual honesty. Commitment to those standards is a responsibility of every student, faculty, and staff member on the University of Colorado at Boulder campus.

Honor Code

A student-run Honor Code was instituted on the Boulder Campus in 2002. The intent of the Honor Code is to establish a community of trust where students do not plagiarize, cheat, or obtain unauthorized academic materials. An honor code council collaborates with the colleges and schools in addressing allegations and instances of academic dishonesty and in assisting to educate all members of the university community on academic integrity issues.

Breaches of academic honesty include cheating, plagiarism, and the unauthorized possession of examinations, papers, computer programs, as well as other class materials specifically released by the faculty.

A student accused of academic dishonesty will either accept the accusation made by a faculty member or request a hearing before a student panel, who will make a decision on the accusation of academic dishonesty. In addition to academic sanctions imposed by the faculty, students found guilty of academic dishonesty also face consequences from the honor code council ranging from attending a mandatory class in ethics to expulsion from the campus. More information about CU-Boulder's Honor Code may be found at www.colorado.edu/academics/honorcode/Home.html.

The following terms are clarified for the benefit of all members of the university community.

Cheating

Cheating is defined as using unauthorized materials or receiving unauthorized assistance during an examination or other academic exercise. Examples of cheating include: copying the work of another student during an examination or other academic exercise (includes computer programming), or permitting another student to copy one's work; taking an examination for another student or allowing another student to take one's examination; possessing unauthorized notes, study sheets, examinations, or other materials during an examination or other academic exercise; collaborating with another student during an academic exercise without the instructor's consent; and/or falsifying examination results.

Plagiarism

Plagiarism is defined as the use of another's ideas or words without appropriate acknowledgment. Examples of plagiarism include: failing to use quotation marks when directly quoting from a source; failing to document distinctive ideas from a source; fabricating or inventing sources; and copying information from computer-based sources, i.e., the Internet.

Unauthorized Possession or Disposition of Academic Materials

Unauthorized possession or disposition of academic materials may include: selling or purchasing examinations, papers, reports or other academic work; taking another student's academic work without permission; possessing examinations, papers, reports, or other assignments not released by an instructor; and/or submitting the same paper for multiple classes without advance instructor authorization and approval.

Reproduced from: http://www.colorado.edu/policies/academic-integrity-policy

Check out http://www.umuc.edu/writingcenter/plagiarism/ for explicit examples.

Statements Recommended by Associate Vice Chancellor for Undergraduate Education

1. *Recommended syllabus statement on disabilities*:
   If you qualify for accommodations because of a disability, please submit to your professor a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least one week prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at dsinfo@colorado.edu.
   If you have a temporary medical condition or injury, see Temporary Injuries under Quick Links at Disability Services website (http://disabilityservices.colorado.edu/) and discuss your needs with your professor.

2. *Recommended syllabus statement on religious observances*:
   Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Please speak with me if you have a conflict. See policy details at http://www.colorado.edu/policies/fac_relig.html/

3. *Recommended syllabus statement on classroom behavior*:
   Students and faculty each have responsibility for maintaining an appropriate learning environment. Students who fail to adhere to behavioral standards may be subject to discipline. Faculty have the professional responsibility to treat students with understanding, dignity and respect, to guide classroom discussion and to set reasonable limits on the manner in which students express opinions. See policies at http://www.colorado.edu/policies/classbehavior.html/ and at http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code/

4. The Office of Discrimination and Harassment:
   The University of Colorado Boulder (CU-Boulder) is committed to maintaining a positive learning, working, and living environment. The University of Colorado does not discriminate on the basis of race, color, national origin, sex, age, disability, creed, religion, sexual orientation, or veteran status in admission and access to, and treatment and employment in, its educational programs and activities. (Regent Law, Article 10, amended 11/8/2001). CU-Boulder will not tolerate acts of discrimination or harassment based upon Protected Classes or related retaliation against or by any employee or student. For purposes of this CU-Boulder policy, "Protected Classes" refers to race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, or veteran status. Individuals who believe they have been discriminated against should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Student Conduct (OSC) at 303-492-5550. Information about the ODH, the above referenced policies, and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at http://hr.colorado.edu/dh/

5. *Recommended syllabus statement on the Honor Code*: All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Additional information on the Honor Code can be found at

   http://www.colorado.edu/policies/honor.html/ and at
   http://www.colorado.edu/academics/honorcode/

References

Bimler, D., & Kirkland, J. (2001). Categorical perception of facial expressions of emotion: Evidence from multidimensional scaling. *Cognition & Emotion, 15*(5), 633-658. doi: 10.1080/02699930143000077

Blumenthal, J. A. (2007). Perceptions of Crime: A multidimensional analysis with implications for Law and Psychology. *McGeorge Law Review, 38*(3), 629–651.

Borg, I., Groenen, P. J. F., & Mair, P. (2013). *Applied multidimensional scaling*. Heidelberg ; London: Springer.

Casasanto, D. (2008). Similarity and proximity: When does close in space mean close in mind? *Memory & Cognition, 36*(6), 1047-1056.

Cha, J.-e., Kim, S., & Lee, Y. (2009). Application of multidimensional scaling for marketing-mix modification: A case study on mobile phone category. *Expert Systems with Applications, 36*(3, Part 1), 4884-4890. doi: http://dx.doi.org/10.1016/j.eswa.2008.05.050

Janal, M. N., Clark, W. C., & Carroll, J. D. (1991). Multidimensional scaling of painful and innocuous electrocutaneous stimuli: Reliability and individual differences. *Perception & Psychophysics, 50*(2), 108-116. doi: 10.3758/BF03212212

Linkovich-Kyle, T. L., & Dunn, M. E. (2001). Consumption-related differences in the organization and activation of marijuana expectancies in memory. *Experimental and Clinical Psychopharmacology, 9*(3), 334-342. doi: http://dx.doi.org/10.1037/1064-1297.9.3.334

Mair, P., de Leeuw, J., & Groenen, P. J. F. (2015). Multidimensional Scaling in R: SMACOF (Vol. v. 1.7, pp. 1–30).

Rather, B. C., & Goldman, M. S. (1994). Drinking-related differences in the memory organization of alcohol expectancies. *Experimental and Clinical Psychopharmacology, 2*(2), 167-183. doi: 10.1037/1064-1297.2.2.167

Robinson, S. L., & Bennett, R. J. (1995). A typology of deviant workplace behaviors: A multidimensional scaling study. *Academy of Management Journal, 38*(2), 555-572. doi: 10.2307/256693

Segerstrom, S. C., Stanton, A. L., Alden, L. E., & Shortridge, B. E. (2003). A Multidimensional Structure for Repetitive Thought: What's on Your Mind, and How, and How Much? *Journal of Personality and Social Psychology, 85*(5), 909-921. doi: 10.1037/0022-3514.85.5.909

Sumiyoshi, C., Sumiyoshi, T., Roy, A., Jayathilake, K., & Meltzer, H. Y. (2006). Atypical antipsychotic drugs and organization of long-term semantic memory: multidimensional

scaling and cluster analyses of category fluency performance in schizophrenia. *The International Journal of Neuropsychopharmacology, 9*(6), 677-683.