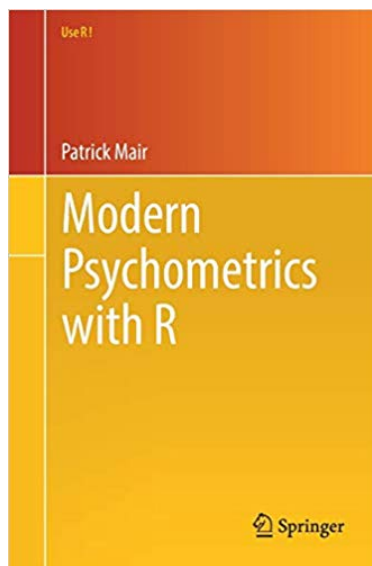


Modern Psychometrics with R

PSYC 4541-002 and PSYC 5541-802

Spring 2020, Monday, Wednesday, Friday, 11:00–11:50
Muenzinger D346

Lewis O. Harvey, Jr. – Instructor



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Modern Psychometrics with R

The course is built around Patrick Mair's new book of the same title. What will be covered will depend who is enrolled in the class. Ideally the students would have some particular data analysis problem that they would like to solve. These problems would determine what we would actually do in the during the semester. The overarching theme is *Latent Variables and Where to Find Them* (thank you J. K. R.). Searching for latent variables covers a wide range of topics, most of them not usually discussed under one conceptual framework: e.g., signal detection theory, test-item analysis, optimized scaling analysis, path analysis, factor analysis, structural equations, preference analysis and multidimensional scaling analysis. The course is aimed at smart, curious, intellectual active advanced undergraduates and honors students working on their data analyses for Spring 2020 as well as graduate students who are interested in expanding their skills in advanced data analysis relevant to their research projects.

The course is divided roughly into three parts:

1. Background reading and in-class presentations of by students related to their primary interests
2. Introduction of new student-generated reading and the formulation of testable hypotheses
3. Analyses of data that test the hypotheses. Students will make presentations of their research findings both in class and at the Spring Undergraduate Research Day, 29 April 2020)

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 new skills and to have fun doing it.

Office Hours

Name	Lewis O. Harvey, Jr.
Office	MUEN D251b
Hours	Mon, Tues, Thurs 09:00–10:00 and by appointment
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Syllabus Topics and Reading Assignments

13 Jan	Introduction	9 Mar	Background Reading
15 Jan	Latent Variables	11 Mar	Multidimensional Scaling
17 Jan	Signal Detection Theory	13 Mar	Multidimensional Scaling
20 Jan	MLK Day	16 Mar	Background Reading
22 Jan	Classical Test Theory	18 Mar	Biplots
24 Jan	Classical Test Theory	20 Mar	Biplots
27 Jan	Background Reading	23 Mar	Spring Break
29 Jan	Factor Analysis	25 Mar	Spring Break
31 Jan	Factor Analysis	27 Mar	Spring Break
3 Feb	Background Reading	30 Mar	Background Reading
5 Feb	Item Response Theory	1 Apr	Networks
7 Feb	Item Response Theory	3 Apr	Networks
10 Feb	Background Reading	6 Apr	Background Reading
12 Feb	Preference Modeling	8 Apr	Cluster Analysis
14 Feb	Preference Modeling	10 Apr	Cluster Analysis
17 Feb	Background Reading	13 Apr	Projects
19 Feb	Principal Component Analysis	15 Apr	Projects
21 Feb	Principal Component Analysis	17 Apr	Projects
24 Feb	Background Reading	20 Apr	Projects
26 Feb	Correspondence Analysis	22 Apr	Projects
28 Feb	Correspondence Analysis	24 Apr	Projects
2 Mar	Background Reading	27 Apr	Projects
4 Mar	Gifi Optimal Scaling	29 Apr	Undergraduate Research Day
6 Mar	Gifi Optimal Scaling		15:00–17:00, UMC Glenn Miller
		1 May	Final Class Meeting
		3 May	Final Exam
			Sunday (19:30–22:00)

Resources

Tidyverse design guide: <https://design.tidyverse.org/index.html>

2 Unifying principles

The tidyverse is a language for solving data science challenges with R code. Its primary goal is to facilitate the conversation that a human has with a dataset, and we want to help dig a “pit of success” where the least-effort path trends towards a positive outcome. The primary tool to dig the pit is API design: by carefully considering the external interface to a function, we can help guide the user towards success. But it’s also necessary to have some high level principles that guide how we think broadly about APIs, principles that we can use to “break ties” when other factors are balanced.

The tidyverse has four guiding principles:

- It is **human centered**, i.e. the tidyverse is designed specifically to support the activities of a human data analyst.
- It is **consistent**, so that what you learn about one function or package can be applied to another, and the number of special cases that you need to remember is as small as possible.
- It is **composable**, allowing you to solve complex problems by breaking them down into small pieces, supporting a rapid cycle of exploratory iteration to find the best solution.
- It is **inclusive**, because the tidyverse is not just the collection of packages, but it is also the community of people who use them.

These guiding principles are aspirational; they’re not always fully realised in current tidyverse packages, but we strive to make them so.

Comments About the Course

Why Take This Course?

There are four reasons to take this course:

1. To gain an understanding of the basis of our psychological concepts of latent variables;
2. To sharpen your ability to critically evaluate the results of published experiments;
3. To gain practical skills in the use of R and RStudio for analyzing and graphing data, and for preparing reports of your findings;
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 learning methods of modern data analysis, such as those taught in Psychology 2111/3111, to evaluate the results of your experiment. The topics are driven by your interests. You will learn advanced techniques using RStudio including how to prepare journal articles using R-Markdown.

**Statements Required by
Associate Vice Chancellor for Undergraduate Education**

Accommodation for Disabilities

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the [Disability Services website](#). Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition or injury, see [Temporary Medical Conditions](#) under the Students tab on the Disability Services website.

Classroom Behavior

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the policies on [classroom behavior](#) and the [Student Code of Conduct](#).

Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the policy may include: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code (honor@colorado.edu; 303-492-5550). Students who are found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the [Honor Code Office website](#).

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct intimate partner abuse (including dating or domestic violence), stalking, protected-class discrimination or harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or cureport@colorado.edu. Information about the OIEC, university policies, [anonymous reporting](#), and the campus resources can be found on the [OIEC website](#).

Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

Religious Holidays

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please let me know when you have conflicts so we can accommodate you.

See the [campus policy regarding religious observances](#) for full details.