PSYC 971—Data Science and Visualization in R

MWF 3-4:15pm

Web conferencing via Zoom

Jeff Stevens (he/him)

Version 2021-07-07

Course description

This course will introduce students to the fundamental concepts and methods used in the R statistical software package to prepare, visualize, and disseminate data.

Prerequisites

PSYC 350 or equivalent course in introductory research design and analysis.

Course objectives

- Learn how to import, process, and plot data in R using tidyverse
- Gain a basic understanding of general programming principles applied to data preparation, analysis, and visualization
- Apply principles of data visualization to plot data in an informative way
- Produce reproducible manuscripts and presentations with R code embedded

Course expectations

The primary aim of this course is to teach you how to use R. Therefore, reading the assigned texts in advance, attending class, and participating in discussions and exercises is integral to this course and expected. R follows the 'use it or lose it' mantra. Plan on working on it a little bit almost every day. Please don't get behind, as we move quickly through the course, and much of what we learn is cumulative.

Computing requirements

Because this is a web conferencing course, you will need access to a computer with a reliable internet connection in a quiet location where you can listen and talk during class meetings. The only computing requirement beyond that is access to an internet connection via a web browser to use RStudio Cloud. However, you should be using R on your local computer, so you will need a computer with a decent processor and RAM. While we will not be using very large data sets or running massive computations, having a faster computer will allow you to quickly proceed through the in-class demonstrations. To run locally, you will also need to install R, RStudio, a number of R packages, Git, and a probably a Git GUI.

Readings

This course will draw from a number of resources, primarily:

- Hadley Wickham & Garrett Grolemund's *R for Data Science*.
- Clause Wilke's *Fundamentals of Data Visualization*.

Other readings are available in the course schedule.

Assignments

Exercises

Most lectures will be followed with sets of exercises to help you practice implementing the concepts discussed. These will be assessed as complete or incomplete.

Check-ins

At the end of module except the last, there will be a summative assignment over that module's material.

Learning journal

As you learn R, you will pick up all kinds of little gems to help you use it. For example, to add the pipe syntax `%>%` (something you'll be doing a lot in the tidyverse), you can simply type `Ctrl/Cmd-Shift-M`. Keep a journal of these little tricks/hints that you are most excited about to submit at the end of the course. I highly recommend posting them on social media throughout the semester.

Projects

The aim of this course is for you to be able to use R to wrangle, visualize, and disseminate *your* data. Therefore, there will be two projects that involve you applying what you learn in class to your own data. The first project will involve wrangling your data into tidy format and editing values. The second project will involve plotting your data.

CReativity

Personally, I find coding in R to be a lot of fun. One way that people have fun in R is to express their creativity. Choose at least one of the following ways to express your creativity in/about R (you'll receive extra credit if you submit more than one type):

- Course hex sticker—create your own hex sticker for the course
- Meme—create meme about the course (using e.g., Make a Meme or MemeGenerator)
- Generative aRt—create your own generative art using R (getting started blog)
- I'm open to other ways of expressing your cReativity (R cookies?, tidyverse in verse? ode to RStudio?)

Grades

Grade scale

A+	96.5-100	B+	86.5-89.4	C+	76.5-79.4	D	59.5-69.4	F	0-59.4
A	92.5-96.4	B	82.5-86.4	C	69.5-76.4				
A-	89.5-92.4	B-	79.5-82.4						

Grades of C or higher count as passing for Pass/No Pass grading.

Assessment

Grade component	Grade percentage
Exercises (24)	20
Check-ins (6)	25
Learning journal	10
Projects (2)	40
Creativity	5

Course resources and policies

Diversity, inclusion, and wellness

We must treat every individual with respect. We are diverse in many ways, and this diversity is fundamental to building and maintaining an equitable and inclusive campus community. Diversity can refer to multiple ways that we identify ourselves, including but not limited to race, color, national origin, language, sex, disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Each of these diverse identities, along with many others not mentioned here, shape the perspectives that students and faculty bring to our campus. I would like to create a learning environment in this course that supports a diversity of thoughts, perspectives and experiences, and honors participant identities. To help accomplish this:

- If you have a name and/or set of pronouns that differ from those that appear in your official records, please let me know in the course introduction form.
- I (like many people) am still in the process of learning about diverse perspectives and identities. If something was said in class (by me or anyone else) that was uninformed or insensitive or made you feel uncomfortable, please feel free to raise the issue in class, contact me to schedule an opportunity to discuss the issue in person, or submit anonymous feedback via the course feedback form. I recognize the power differential between student and professor, but I promise you, neither your grade nor my opinion of you will be impacted by your willingness to bring issues to me.
- If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to talk with me. Your wellness is important to me, and I do not want this course to adversely affect your mental health. I am invested in your understanding of the course material and am happy to make accommodations to achieve the longer-term goal of you learning to use R. Beyond requesting specific accommodations, if you notice something about the class structure or assignments that could be made to improve universal accessibility, please let me know. Sometimes you might be able to work around a barrier, and not go to the trouble of going through the SSD to request a formal accommodation – but over time, working around barriers takes a toll. If I am made aware of those issues, we are better able to remove them so you can focus fully on your work.
- Unfortunately, incidents of bias or discrimination do occur, whether intentional or unintentional. They contribute to creating an unwelcoming environment for individuals and groups at the university. Therefore, the university encourages anyone who experiences or observes unfair or hostile treatment on the basis of identity to speak out for justice and support, within the moment of the incident or after the incident has passed. As noted above, if this happens in the context of this class, I encourage you to come talk to me so we can figure out together how to address the issue and find you the support you need. At a broader institutional level, resources are available at Title IX Resources and Support and incidents can be reported through the TIPS system.

Resources for students seeking mental health help

UNL offers a variety of options to students to aid them in dealing with stress and adversity. Counseling and Psychological & Services (CAPS) is a multidisciplinary team of psychologists and counselors that works collaboratively with Nebraska students to help them explore their feelings and thoughts and learn helpful ways to improve their mental, psychological and emotional well-being when issues arise. CAPS can be reached by calling 402-472-7450. Big Red Resilience & Well-Being (BRRWB) provides one-on-one well-being coaching to any student who wants to enhance their well-being. Trained well-being coaches help students create and be grateful for positive experiences, practice resilience and self-compassion, and find support as they need it. BRRWB can be reached by calling 402-472-8770.

Accommodations for students with disabilities

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can discuss options privately. To establish reasonable accommodations, I may request that you register with Services for Students with Disabilities (SSD). If you are eligible for services and

register with their office, make arrangements with me as soon as possible to discuss your accommodations so they can be implemented in a timely manner. SSD contact information: 117 Louise Pound Hall; 402-472-3787.

Class materials use and distribution

We invite all of you to join us in actively creating and contributing to a positive, productive, and respectful classroom culture. Each student contributes to an environment that shapes the learning process. Any work and/or communication that you are privy to as a member of this course should be treated as the intellectual property of the speaker/creator, and is not to be shared outside the context of this course.

Students may not make or distribute screen captures, audio/video recordings of, or livestream, any class-related activity, including lectures and presentations, without express prior written consent from the coordinator or discussion leader or an approved accommodation from Services for Students with Disabilities. If you have (or think you may have) a disability such that you need to record class-related activities, you should contact Services for Students with Disabilities. If you have an accommodation to record class-related activities, those recordings may not be shared with any other student, whether in this course or not, or with any other person or on any other platform. Failure to follow this policy on recording or distributing class-related activities may subject you to discipline under the Student Code of Conduct.

Academic dishonesty policy

You are responsible for knowing and adhering to the UNL Student Code of Conduct. Any student found guilty of academic dishonesty, including (but not limited to) cheating, falsification, and plagiarism, will fail the course and may be subject to disciplinary sanctions.

- *Cheating*: Copying or attempting to copy from an academic test or examination of another student; using or attempting to use unauthorized materials, information, notes, study aids or other devices for an academic test, examination or exercise; engaging or attempting to engage the assistance of another individual in misrepresenting the academic performance of a student; or communication information in an unauthorized manner to another person for an academic test, examination or exercise.
- *Fabrication or Falsification*: Falsifying or fabricating any information or citation in any academic exercise, work, speech, research, test or examination. Falsification is the alteration of information, while fabrication is the invention or counterfeiting of information.
- *Plagiarism*: Presenting the work of another as one's own (i.e., without proper acknowledgement of the source) and submitting examination, theses, reports, speeches, drawings, laboratory notes or other academic work in whole or in part as one's own when such work has been prepared by another person or copied from another person. Materials covered by this prohibition include, but are not limited to, text, video, audio, images, photographs, websites, electronic and online materials, and other intellectual property. **Copying material from other sources with minor modifications is considered plagiarism.**
- *Complicity in Academic Dishonesty*: Helping or attempting to help another student to commit an act of academic dishonesty.
- *Impermissible Collaboration*: Collaborating on any academic exercise, work, speech, test or examination unless expressly authorized by the faculty member. It is the obligation of the student to know whether collaboration is permitted.

Course schedule

Week	Date	Topic	Readings
1	2021-05-17	Data science and R	SIDS 1, RYWM 1, Wickham 2020
	2021-05-19	Coding basics	R4DS Ch. 1, 4, 6, 8
	2021-05-21	Version control	Bryan 2017
2	2021-05-24	Literate programming	R4DS Ch. 27, Markdown tutorial
	2021-05-26	Data types and structures	R4DS Ch. 20
	2021-05-28	Importing and exporting data	R4DS Ch. 11
3	2021-05-31	Cleaning columns	R4DS Ch. 5.1, 5.4, 5.5
	2021-06-02	Wrangling rows	R4DS Ch. 5.2, 5.3, 5.6
	2021-06-04	Tidy data	R4DS Ch. 12
4	2021-06-07	Merging data	R4DS Ch. 13
	2021-06-09	Character strings	R4DS Ch. 14
	2021-06-11	Factors, dates, and times	R4DS Ch. 15, 16
5	2021-06-14	Functions and flow	R4DS Ch. 19, 21
	2021-06-16	Grammar of graphics	R4DS Ch. 3, FDV Ch. 1, 2, 3
	2021-06-18	Design and style	FDV Ch. 17, 25, 26, 29
6	2021-06-21	Color	FDV Ch. 4, 19
	2021-06-23	Visualizing distributions	FDV Ch. 7, 8, 9
	2021-06-25	Visualizing amounts and proportions	FDV Ch. 6, 10, 11
7	2021-06-28	Visualizing x-y data	FDV Ch. 12, 13, 14
	2021-06-30	Finessing plots	FDV Ch. 18, 20, 21, 23
	2021-07-02	Adorning plots	FDV Ch. 22.1-22.2, 24, R4DS Ch. 28
8	2021-07-05	Extending plots	FDV Ch. 16, 27
	2021-07-07	Tables	FDV Ch. 22.3, RMC 10.1
	2021-07-09	TBA	

FDV = Fundamentals of Data Visualization, R4DS = R for Data Science, RMC = R Markdown Cookbook, RYWM = RYouWithMe, SIDS = Statistical Inference via Data Science