Syllabus

Camille Seaberry

2024-01-01

At its essence, the aim of data visualization is to move data and its meaning(s) and context(s) from some origin (spreadsheets, observed phenomena, etc.) to a larger audience. It's a spectrum of incredibly powerful tools for not just understanding and explaining facts, but also for shaping what those facts are and creating the narrative around them. By the end of this course, you will have thought through your role and responsibility in an evolving field, developed a set of best practices that is likely to continue to change, engaged with larger social currents toward your own goals, and strengthened your skills in R.

Because this is part of a professional studies program based on open source software and the ethos behind it, the course will be very hands-on and require everyone's willingness to contribute and participate. Instead of tests and graded homework assignments, we'll focus on practice, critique, and revision, building continuously on individual projects and shared tools. To some extent, the class structure will mimic a workplace, where you have projects with checkpoints and meetings to brainstorm and workshop your ideas, with time to work both in class and on your own at home.

Because data science and data visualization—and the software we use for both—change so quickly, a lot of the community's discourse happens in less formal settings, such as blogs, social media, podcasts, and workshops, rather than just traditional academic journals and books. Our readings (defined loosely enough to include videos of talks, podcasts, and simply browsing through data visualization projects) will likewise fall along this spectrum, and you'll have some flexibility in what you read and share.

Above all, I want this to be a course that is useful to you as you build a career of critical engagement with data. The schedule is intentionally loose so we can adjust based on skills we may want or need to build upon, and each student's goals and interests. Please be willing to share what you want to learn, contribute resources, and ask for what you need of me and each other.

Objectives

The first half of the course will be focused on non-spatial data visualization; the second half will be focused on spatial data and how to integrate the two. Some of the principles we go over for non-spatial and spatial will differ, but objectives remain the same.

By the end of the course, students will:

- Have an understanding of the **basics of visual perception**, and how to use that knowledge to design data visualizations well
- Be familiar with the **grammar of graphics** framework to think about components and purposes of visual elements
- Be skilled in **programming in R** and using the ggplot2 data visualization ecosystem
- Know how to **give and receive constructive feedback** on visualizations, both their own and others', and to revise and improve upon their work
- Be able to **identify potential harms** done by inappropriate or misleading visualizations, and make corrections
- Be able to make, articulate, and argue for **good decisions** in designing charts and maps
- Have made many, many unpolished visualizations and several polished, presentation-ready ones

Successful students will finish the course with finished products for their portfolios of high enough quality to include with applications to jobs or other academic programs:

- 1–2 completed, **presentation-ready data visualization projects**
- **reproducible, documented code** that can be repurposed at another organization
- contributions to an **open source codebase**

Materials

Readings

All readings will be available to students for free. Many will be open source texts and have code available. Readings will be a mix of theory and practice.

The schedule of the course will roughly follow the structure of the book *Fundamentals of Data Visualization* (Wilke 2019). Both the book and the source code used to write it are available for free online.

We'll also read portions of *R for Data Science* (Wickham, Çetinkaya-Rundel, and Grolemund 2023) (also open source), *How Charts Lie* (Cairo 2019), and *Data Points* (Yau 2013), as well as a variety of other sources of different media. I'll keep a running list of resources in the online class notes with other tutorials and references.

Software

This is a rough set of the software and tools we will use, with open source software in italics:

- *R programming language*
- *ggplot2 and related packages*
- *RStudio* or another integrated development environment
- *Quarto,* a markdown-based publishing system from the same team as RStudio
- *git* for version control, GitHub for storage of version-controlled materials, and GitHub Classroom for discussions and submitting code
- Blackboard for assignments and announcements

I'm open to suggestions on any other tools you all think would be useful.

Other tools

If at all possible, **you should have a laptop of your own** for this class. All the software we're using is free and open source, so you should be able to install everything on your computer. If you do not have a laptop, you can borrow one from the library, or, because we will be using git for version tracking and GitHub for storage, you can use a lab computer and make sure to upload your work regularly.

We'll be doing a lot of sketching by hand (you don't have to be good at drawing), so you'll need **a notebook and pens or pencils** that are nice to doodle with. I highly, *highly* recommend finding a graph paper or dotted notebook.

Schedule

The schedule has some flexibility built into it, but tentatively goes as follows:

Week	Section	Topic
1	Non-spatial data viz	What is a chart, and do you need one?
2		Encoding data to visuals; making meaning of your data
3		Writing good code; working with color
4		Text and annotation; uncertainty and distribution
5		Making good decisions pt. 1
6		Accessibility, literacy, and audience
7		Storytelling pt. 1 (empathy & equity); experimentation
		Project 1 due
8	Spatial data viz	What is a map, and do you need one?
9		Encoding data to space; harmful practices

Week	Section	Topic
10		Color, text, and annotations pt. 2
11		Making good decisions pt. 2
12		Storytelling pt. 2 (history & cohesion); experimentation
13		Final critique; tying up loose ends
14		Finishing touches on projects
		Project 2 due

Class structure

A typical class session will be roughly:

Activity	Time
Warm-up	5-10 minutes
Report-backs	10-15 minutes, if any
Lecture	1 hour max + questions
Workshop, critique, or lab	Remaining time

Grading

In data visualization there aren't any perfectly right answers, and there aren't too many perfectly wrong ones either. As a result, rather than tedious quizzes and problem sets, your grade will reflect the effort you put into developing your process and your critical eye, and how successfully you create compelling stories with data.

Participation

There will be opportunities for participation points every week, including:

- Bringing in visualizations you've found for us to discuss
- Opening your work up for workshopping
- Contributing code (there's an R package in development for this class), with more points given for students with less experience in R—this includes the less glamorous but crucial tasks of testing, debugging, and documenting
- Doing an optional reading or attending a talk and reporting back to the class on some interesting things you learned
- Adding a resource to the class notes

There will be two opportunities to lose points as well:

- Being mean or unnecessarily harsh in critique
- Unexcused absences (see below)

There's no set number of participation points you need—just rack them up when you can, forgo them when you have to, and I'll scale them at the end of the semester. Notice that most of these involve contributing to your classmates' growth as well as your own.

Projects

There will be 2 projects, one midterm and one final, that you'll be working on throughout the semester. Both will build upon the exercises, and you'll have lots of time to work on them in class and receive feedback from myself and your peers. The first will be non-spatial data, and the second will be both spatial and non-spatial. You'll be responsible for moving from a dataset through to a polished visualization that tells a story and has real-world impact. You will also document your process along the way and have check-ins regularly. Each project will also have a semi-formal write-up to explain what you did and why, and to situate your work into the theory and principles we study.

Other assignments

We'll have a few more small assignments, including short case studies and peer reviews.

Grading scale

Grades will be rounded to the nearest whole percent.

Grade	Percentage
A+	97% +
A	93-96%
A-	90-92%
B+	87-89%
B	83-86%
B-	80-82%
C+	77-79%
C	73-76%
C-	70-72%
D+	67-69%

Grade	Percentage
D	63-66%
D-	60-62%
F	< 60%

Grade distribution

Category	Share of grade
Case studies	15%
Peer review & reflections	5%
Participation	20%
Project 1 visualization	20%
Project 1 write-up	5%
Project 2 visualization	25%
Project 2 write-up	10%

Attendance

As grad students, your course load is one of many responsibilities you juggle, so I know things will come up from time to time that prevent you from getting to class. If you need to miss class or will be late, just let me know in advance (email or DM), and as long as absences don't become excessive, it should be fine. If there is some reason you'll need to miss class several times, such as chronic illness (after all, COVID's still here), just let me know and we can figure something out. If you can't attend class but are able to participate remotely, I can stream on Zoom or WebEx.

Unexcused absences, except for a serious emergency (e.g. you got into a car accident on the way to campus), will cost you participation points. Excused absences will not.

UMBC policies and resources

Accessibility and Disability Accommodations, Guidance and Resources

Accommodations for students with disabilities are provided for all students with a qualified disability under the Americans with Disabilities Act (ADA & ADAAA) and Section 504 of the Rehabilitation Act who request and are eligible for accommodations. The Office of Student

Disability Services (SDS) is the UMBC department designated to coordinate accommodations that creates equal access for students when barriers to participation exist in University courses, programs, or activities.

If you have a documented disability and need to request academic accommodations in your courses, please refer to the SDS website at sds.umbc.edu for registration information and office procedures.

SDS email: disAbility@umbc.edu

SDS phone: 410-455-2459

If you will be using SDS approved accommodations in this class, please contact the instructor to discuss implementation of the accommodations. During remote instruction requirements due to COVID, communication and flexibility will be essential for success.

Sexual Assault, Sexual Harassment, and Gender Based Violence and Discrimination

UMBC Policy in addition to federal and state law (to include Title IX) prohibits discrimination and harassment on the basis of sex, sexual orientation, and gender identity in University programs and activities. Any student who is impacted by sexual harassment, sexual assault, domestic violence, dating violence, stalking, sexual exploitation, gender discrimination, pregnancy discrimination, gender-based harassment, or related retaliation should contact the University's Title IX Coordinator to make a report and/or access support and resources. The Title IX Coordinator can be reached at titleixcoordinator@umbc.edu or 410-455-1717.

You can access support and resources even if you do not want to take any further action. You will not be forced to file a formal complaint or police report. Please be aware that the University may take action on its own if essential to protect the safety of the community.

If you are interested in making a report, please use the Online Reporting/Referral Form. Please note that, if you report anonymously, the University's ability to respond will be limited.

Notice that Faculty and Teaching Assistants are Responsible Employees with Mandatory Reporting Obligations

All faculty members and teaching assistants are considered Responsible Employees, per UMBC's Policy on Sexual Misconduct, Sexual Harassment, and Gender Discrimination. Faculty and teaching assistants therefore required to report all known information regarding alleged conduct that may be a violation of the Policy to the Title IX Coordinator, even if a student discloses an experience that occurred before attending UMBC and/or an incident that only involves people not affiliated with UMBC. Reports are required regardless of the amount of detail provided and even in instances where support has already been offered or received.

While faculty members want to encourage you to share information related to your life experiences through discussion and written work, students should understand that faculty are required to report past and present sexual harassment, sexual assault, domestic and dating violence, stalking, and gender discrimination that is shared with them to the Title IX Coordinator so that the University can inform students of their rights, resources, and support. While you are encouraged to do so, you are not obligated to respond to outreach conducted as a result of a report to the Title IX Coordinator.

If you need to speak with someone in confidence, who does not have an obligation to report to the Title IX Coordinator, UMBC has a number of Confidential Resources available to support you:

Retriever Integrated Health (Main Campus): 410-455-2472; Monday – Friday 8:30 a.m. – 5 p.m.; For After-Hours Support, Call 988.

Center for Counseling and Well-Being (Shady Grove Campus): 301-738-6273; Monday-Thursday 10:00a.m. – 7:00 p.m. and Friday 10:00 a.m. – 2:00 p.m. (virtual) Online Appointment Request Form

Pastoral Counseling via The Gathering Space for Spiritual Well-Being: 410-455-6795; i3b@umbc.edu; Monday – Friday 8:00 a.m. – 10:00 p.m.

Other Resources

Women's Center (open to students of all genders): 410-455-2714; womenscenter@umbc.edu; Monday – Thursday 9:30 a.m. – 5:00 p.m. and Friday 10:00 a.m. – 4 p.m.

Shady Grove Student Resources, Maryland Resources, National Resources.

Child Abuse and Neglect

Please note that Maryland law and UMBC policy require that faculty report all disclosures or suspicions of child abuse or neglect to the Department of Social Services and_/_or the police even if the person who experienced the abuse or neglect is now over 18.

Pregnant and Parenting Students

UMBC's Policy on Sexual Misconduct, Sexual Harassment and Gender Discrimination expressly prohibits all forms of discrimination and harassment on the basis of sex, including pregnancy. Resources for pregnant, parenting and breastfeeding students are available through the University's Office of Equity and Civil Rights. Pregnant and parenting students are encouraged to contact the Title IX Coordinator to discuss plans and ensure ongoing access to their academic program with respect to a leave of absence – returning following leave, or any

other accommodation that may be needed related to pregnancy, childbirth, adoption, breast-feeding, and/or the early months of parenting.

In addition, students who are pregnant and have an impairment related to their pregnancy that qualifies as disability under the ADA may be entitled to accommodations through the Office of Student Disability Services.

Religious Observances & Accommodations

UMBC Policy provides that students should not be penalized because of observances of their religious beliefs, and that students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. It is the responsibility of the student to inform the instructor of any intended absences or requested modifications for religious observances in advance, and as early as possible. For questions or guidance regarding religious observances and accommodations, please contact the Office of Equity and Civil Rights at ecr@umbc.edu.

Hate, Bias, Discrimination and Harassment

UMBC values safety, cultural and ethnic diversity, social responsibility, lifelong learning, equity, and civic engagement.

Consistent with these principles, UMBC Policy prohibits discrimination and harassment in its educational programs and activities or with respect to employment terms and conditions based on race, creed, color, religion, sex, gender, pregnancy, ancestry, age, gender identity or expression, national origin, veterans status, marital status, sexual orientation, physical or mental disability, or genetic information.

Students (and faculty and staff) who experience discrimination, harassment, hate, or bias based upon a protected status or who have such matters reported to them should use the online reporting/referral form to report discrimination, hate, or bias incidents. You may report incidents that happen to you anonymously. Please note that, if you report anonymously, the University's ability to respond may be limited.

UMBC Writing Center

The Academic Success Center offers free writing assistance through our Writing Center, which is located on the first floor of the Library. We also offer online and asynchronous tutoring. Writing tutors are students like you who receive ongoing training to stay up-to-date on the best tutoring techniques. To make an appointment, please visit http://academicsuccess.umbc.edu/writing-center

Cairo, Alberto. 2019. *How Charts Lie: Getting Smarter about Visual Information*. First edition. New York: W. W. Norton & Company.

Wickham, Hadley, Mine Çetinkaya-Rundel, and Garrett Grolemund. 2023. *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*. 2nd edition. O'Reilly. https://r4ds.hadley.nz/.

Wilke, Claus. 2019. *Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures*. First edition. O'Reilly. https://clauswilke.com/dataviz/.

Yau, Nathan. 2013. *Data Points: Visualization That Means Something*. Indianapolis, IN: John Wiley & Sons, Inc.