

PPPA 6021 Spring 2023

Syllabus | Lectures | Resources

Data Visualization

Course Logistics

- » Mondays, 3:30 to 5:20
 - » Tompkins 205
 - » NOTE: Wednesday, May 3 is a “designated Monday” and is our last class

Course Description and Learning Goals

Course Purpose

Not all graphics are created equal: some lie, some obscure, some illuminate, and some compel. This course studies how to spot lies and obfuscation and teaches you how to illuminate and compel. In this class, we learn how to distill large quantities of data into pictures that communicate.

Ideally, policy choices are driven by information. Because of its ability to generalize across large populations, the most credible information is frequently quantitative. However, data alone tell no story. Without visualization, it is very difficult for data to influence policy. This course challenges you to take raw numbers and create a story that can change impressions, long-held beliefs and ultimately policy. Together, we learn to tell stories with numbers using graphics.

Learning Objectives

- » Value high quality data graphics
- » Present data to illustrate a narrative that influences policy
- » Understand how visualizations can rapidly and accurately convey a large amount of quantitative data
- » Follow the logic of technical software that creates data visualizations
- » Implement your own programming logic
- » Critically analyze data visualizations
- » Work with big-ish datasets to produce summary analyses

- » Use summary statistics -- from econometrics and research methods courses -- appropriately in producing graphics
- » Recognize the limits of cognition of visually displayed data, and produce graphics that speak to the broadest possible audience

Contact and Office Hours

Professor: Leah Brooks

Media and Public Affairs Building, Room 601F

Office Hours: Mondays, 8:15 PM to 9:15 PM (last appt ends at 9:30); Tuesdays 10:30 AM to 1 PM.

- » Use the [scheduler](#) to book a 15-minute slot
- » If there are no other students waiting, I am happy to talk beyond the 15 minute limit
- » Office hours are by Zoom, unless you would prefer to meet in person, which I can usually accommodate with advance notice.
- » Your confirmation email from the scheduler will contain the Zoom link
- » No office hours Mondays Feb. 20, April 3, April 17; Tuesdays Feb. 21, April 18.

lfbrooks at gwu.edu, but please use Piazza email for all non-private issues

Contact policy: I will do my best to answer emails within 24 hours during weekdays, or within 24 hours on the soonest weekday if you email on the weekend. If you do not hear from me within this time frame, you should assume that your email has been lost and you should re-send.

If you have missed a class, your first line of defense to ask what you have missed is another student.

Prerequisites

PPPA 6013: Econometrics for Policy Research I

- » I do not assume prior programming knowledge, either in R or any other statistical programming language.
- » Because this class focuses on learning the basics of statistical programming, expect a greater time commitment if you have no prior programming experience.

Readings

Required Readings See lectures tab for reading dates and specific pages.

- » Few, Stephen, *Show Me the Numbers: Designing Tables and Graphs to Enlighten*
- » **R Graphics Cookbook: Practical Recipes for Visualizing Data*. Available online for free [here](#)
- » *Knaflic, Cole Nussbaumer *Storytelling with Data*
- » Tufte, Edward, *The Visual Display of Quantitative Information*
- » Monmonier, Mark *How to Lie with Maps*, any edition is fine.
- » Monmonier, Mark *Mapping it Out: Expository Cartography for the Humanities and Social Sciences*

Books marked with a * are available online at the GW library.

See full details with chapter and dates on [readings](#) tab.

These books are on order at the campus bookstore, and are widely available online. I have tried to link to all remaining content from this syllabus. Please let me know if you have difficulties with any of the links, or with permissions.

Supplemental Readings -- For Reference

- » Lima, Manuel, *Visual Complexity: Mapping Patterns of Information*, available online at GW Library
- » *Learning R*
- » Schwabish, Jonathan, *Better Presentations: A Guide for Scholars, Researchers and Wonks*
- » Other Data Visualization Courses
 - » Enrico [Bertini](#)
- » Newman, Winifred E. *Data Visualization for Design Thinking: Applied Mapping*
- » Brunsdon and Comber, *An Introduction to R for Spatial Analysis and Mapping*
- » Healy, Kieran, *Data Visualiation: A Practical Introduction*
- » Brewer, Cynthia A., *Designing Better Maps: A Guide for GIS Users*
- » Wilkinson, Leland, et al, *The Grammar of Graphics*
 - . The intellectual inspiration for ggplot.
- » W.E.B. DuBois Center, *W.E.B. DuBois's Data Portraits: Visualizing Black America*

Weekly Plan

Each week, the in-class lecture is half design principles and half R coding. I expect that you do the associated reading before arriving in class. In class, we will discuss the readings and the R lesson for the week. To recap,

Before Class

- » You read the assigned texts
- » Shortly before class, I post the week's programming tutorial

During Class

- » Administration overview
- » Good, Bad and Ugly
- » Answer questions from reading
- » Present lecture on design principles and coding
- » You work on coding

I aim to end class 20 to 30 minutes before 5:20. I encourage you to use this remaining time to start on the tutorial so that I can help with problems as they arise. I will always stay until 5:20 to answer any remaining questions or provide programming help.

Outside of class

- » Use Piazza for coding questions
- » Familiarize yourselves with features that show blocks of code
- » Learn how to create a “minimal reproducible example” of your problem. See Stack Overflow's excellent description [here](#)

Assessment and Evaluation of Learning

1. Weekly Programming Practice (30%)

- » Creating data visualizations requires technical knowledge.
- » These problem sets are designed to develop your R skills so you can successfully create the final project.
- » You will begin these tasks in class each week; you need to finish them by the following class to turn in on paper in class and online at the beginning of class.
- » Logistics
 - » The final product should be typed.
 - » Of the 10 weeks with programming practice, seven weeks of assignments will count toward your grade.

- » Each class I will provide a structured handout to follow with questions to answer.
- » Submit write-up online by the beginning of the following class.

» I grade this assignment pass/fail

» Work with others on these assignments. Whatever you turn in, however, needs to be in your own words; no work should directly duplicate classmates' work.

» I accept no late assignments

2. One Fully Composed Chart (5%)

» This assignment is a warm-up for your policy brief and a chance to get feedback before the policy brief.

» Lecture 5 you will turn in a fully-executed graph on the topic of your choice, along with the code in R.

» See further details in handout.

» I do not accept late assignments

3. Visualizations: The Good, the Bad and the Ugly (5%)

» One of the goals of this course is for you to recognize quality data visualizations and misleading data visualizations.

» This will help you review and identify the strategies from the previous class, and will require you to explain the strengths and weaknesses of the graphics.

» To this end, two students each week will find a visualization that can be improved based on the previous week's class.

» We will post them on the course website and each student is responsible for bringing three specific discussion points on the graph for the beginning of class.

» We will make assignments for this activity the first class.

» No late assignments are accepted.

4. Policy Brief (40%)

» A policy brief -- a version of a short memo -- is the primary method of policy communication. This assignment asks you to create such a memo.

» For our final class, you will turn in an approximately five page policy brief, with approximately five data visualizations.

» This project includes interim steps described below.

» The goal of this exercise is for you to

» Connect what we've learned in course with policy

» Practice R

» Direct inquiry toward an unstructured project

- » Challenge your newly developed visualization skills
- » You are required to use micro data, in the sense that the data you load are less aggregated than (at least) some of the data you present.
- » For relevant briefs, you are very welcome to post on the Center for Washington Area Studies page
- » Logistics
 - » Paper is due the Monday following the final lecture.
 - » You are welcome, but not required, to work in pairs. Requirements do not differ if you work in pairs; you should correctly interpret this as an incentive to work in pairs.
 - » Extensions will be given only the case of illness
 - » Briefs will be graded out of 100 points
 - » Any essays submitted late will decline by ten points for each twelve hours the essay is late, e.g. if the essay is due on Friday and is received Monday, if it would have received 70%, it now receives 30%

5. Interim Assignments for Policy Brief (total of 10%)

- » Policy Brief Proposal (5%)
 - » To make sure that you have chosen a manageable assignment, on week 3 you will turn in a description of what you are planning to visualize
 - » This should be one page or less. It should identify your data source(s), and outline what you'd like to say.
 - » I will provide written feedback on your proposal within one week of submission.
 - » I will comment on, but not give credit for, late work
- » In-class Storyboarding Workshop (0%)
 - » Week 7 you will work together with your classmates to tell a story with your findings
 - » This will be an in-class (synchronous) activity
- » Policy Brief Workshop (5%)
 - » To make sure that you are on track to complete a high-quality policy brief at the end of the semester, and to hone your critical visualization skills, on week 9 you will produce a draft of your policy brief for peer feedback.
 - » Specifically, you will post a draft of your policy brief, complete with draft visualizations, and give and receive feedback on these visualizations.

- » We will work in small groups that I will assign, and you comment on your group members' work
- » I will provide more details in a handout in week 7
- » Policy Brief Presentations (5%)
 - » We use classes 13 and 14 for presentations of your policy briefs
 - » Half of your grade will be based on your comments on your classmates' presentations (2.5%)
 - » Half of your grade will be based on your presentation (2.5%)
 - » I will provide more details for this activity closer to the date.
 - » No late work is accepted

6. Class Participation (5%)

- » To make sure you're up to date with the reading -- which should help you understand the creation of good graphics -- I will ask questions of all students in each class.
- » Come prepared to answer questions

Course Material Copyright

Course materials posted on this website, Piazza, or elsewhere are intellectual property belonging to the author. Students are not permitted to buy or sell any course materials without the express permission of the instructor. Such unauthorized behavior constitutes academic misconduct.

Accommodations

We want to provide an environment that helps every student in this course succeed. If you have accommodations of which the instructor should be aware, please inform the instructor no later than the first week of the course so we can plan together for a successful semester.

In order to receive accommodations on the basis of disability, you'll need to provide proper documentation to the [Office of Disability Support Services](#), Marvin Center 436, 202-994-8250. We accommodate students based on the recommendations of the DSS Office.

Course Policies

» *The Syllabus*

This syllabus is your guide to the course. If any questions arise, please check the

syllabus before contacting me or the TA. Sound educational practice requires flexibility and I may revise content and requirements during the semester.

» *Inclusivity*

Higher education works best when it becomes a vigorous and lively marketplace of ideas in which all points of view are heard. Free expression in the classroom is an integral part of this process. At the same time, higher education works best when all of us approach the enterprise with empathy and respect for others, irrespective of their ideology, political views, or identity. We value civility because that is the kind of community we want, and we care for it because civility permits intellectual exploration and growth.

» *Student Support*

If you need technical support, other student services, help in obtaining a GWorld card, or any other student service, start at online.gwu.edu/student-support

» *Use of Electronic Course Materials and Class Recordings* Students are encouraged to use electronic course materials, including recorded class sessions, for private personal use in connection with their academic program of study. Electronic course materials and recorded class sessions should not be shared or used for non-course related purposes unless express permission has been granted by the instructor. Students who impermissibly share any electronic course materials are subject to discipline under the Student Code of Conduct. Please contact the instructor if you have questions regarding what constitutes permissible or impermissible use of electronic course materials and/or recorded class sessions. Please contact Disability Support Services at disabilitysupport.gwu.edu if you have questions or need assistance in accessing electronic course materials.

» *Late or Missed Class*

If you are late or absent from class, it is your responsibility to obtain all announcements, assignments, and handouts from this website or from your classmates. As participation is part of your grade, and because attendance in class helps you learn, missing many classes will be detrimental to your final grade. Missing one class should have no effect. You do not need to notify me in advance if you are going to miss class.

» *Exam Dates*

Please notify me in the first two weeks of class if you are aware of a pre-existing conflict, such as a religious holiday you observe, that will preclude you from taking

either exam at the assigned time. To the extent possible, we will work together to reschedule the exam as close to the original date as possible.

» *Submission of Written Work Products Outside of the Classroom*

It is your responsibility to ensure that I receive your assignment on time. If you encounter difficulties with an online portal or submission, it is your responsibility to notify the instructor or TA immediately.

» *Collaboration on Assignments*

You are welcome to work in groups; however, you are expected to write up your answers individually. This means that no phrases on your assignment should mimic phrases on any other student's work.

» *Submission of Written Work Products after Due Date*

All work must be submitted by the assigned due date in order to receive full credit. Only extreme circumstances warrant exceptions. Late assignments are marked down for each day that they are late.

» *Incompletes*

You must consult with me to obtain an incomplete no later than the last day of classes in the semester. At that time, we will both sign the CCAS contract for incompletes and submit a copy to the School Director. Please consult the TSPPPA Student Handbook or visit this [link](#) for the complete CCAS policy on incompletes.

» *Changing Grades After Completion of Course*

No changes can be made in grades after the conclusion of the semester, other than in cases of clerical error.

GWU Policies

University Policies

» *Academic Integrity Code*

Academic integrity is an essential part of the educational process, and all members of the GW community take these matters very seriously. As the instructor of record for this course, my role is to provide clear expectations and uphold them in all assessments. Violations of academic integrity occur when students fail to cite research sources properly, engage in unauthorized collaboration, falsify data, and otherwise violate the Code of Academic Integrity. If you have any questions about whether or not particular academic practices or resources are permitted, you should ask me for clarification. If you are reported for an academic integrity violation, you should contact the Office of Student Rights and Responsibilities (SRR) to learn more

about your rights and options in the process. Consequences can range from failure of assignment to expulsion from the university and may include a transcript notation. For more information, please refer to the SRR website (<https://studentconduct.gwu.edu/academic-integrity>), email rights@gwu.edu, or call 202-994-6757.

» *University policy on observance of religious holidays*

Students must notify faculty during the first week of the semester in which they are enrolled in the course, or as early as possible, but no later than three weeks prior to the absence, of their intention to be absent from class on their day(s) of religious observance. If the holiday falls within the first three weeks of class, the student must inform faculty in the first week of the semester. For details and policy, see “Religious Holidays” at provost.gwu.edu/policies-procedures-and-guidelines.

» *Use of Electronic Course Materials and Class Recordings*

Students are encouraged to use electronic course materials, including recorded class sessions, for private personal use in connection with their academic program of study. Electronic course materials and recorded class sessions should not be shared or used for non-course related purposes unless express permission has been granted by the instructor. Students who impermissibly share any electronic course materials are subject to discipline under the Student Code of Conduct. Please contact the instructor if you have questions regarding what constitutes permissible or impermissible use of electronic course materials and/or recorded class sessions. Please contact Disability Support Services at disabilitysupport.gwu.edu if you have questions or need assistance in accessing electronic course materials.

» *Out of Class Learning*

Average minimum amount of independent, out-of- class, learning expected per week: In a 15 week semester, including exam week, students are expected to spend a minimum of 100 minutes of out-of- class work for every 50 minutes of direct instruction, for a minimum total of 2.5 hours a week.

Academic support

» *Writing Center*

GW’s Writing Center cultivates confident writers in the University community by facilitating collaborative, critical, and inclusive conversations at all stages of the writing process. Working alongside peer mentors, writers develop strategies to write

independently in academic and public settings. Appointments can be booked online at gwu.mywconline.

» *Academic Commons*

Academic Commons provides tutoring and other academic support resources to students in many courses. Students can schedule virtual one-on-one appointments or attend virtual drop-in sessions. Students may schedule an appointment, review the tutoring schedule, access other academic support resources, or obtain assistance at academiccommons.gwu.edu.

» *Coaching*

Coaching, offered through the Office of Student Success, is available in a virtual format. See [OSS](#)

Support for students outside the classroom

» *Disability Support Services*

202-994-8250

Any student who may need an accommodation based on the potential impact of a disability should contact Disability Support Services at disabilitysupport.gwu.edu to establish eligibility and to coordinate reasonable accommodations.

» *Counseling and Psychological Services*

202-994-5300

GW's Colonial Health Center offers counseling and psychological services, supporting mental health and personal development by collaborating directly with students to overcome challenges and difficulties that may interfere with academic, emotional, and personal success. healthcenter.gwu.edu/counseling-and-psychological-services.

» *Safety and Security*

- » Monitor GW Alerts and Campus Advisories to Stay Informed before and during an emergency event or situation
- » In an emergency: call GWPD/EMeRG 202-994-6111 or 911
- » For situation-specific actions: refer to GW's Emergency Response Handbook and Emergency Operations Plan
- » In the event of an armed intruder: Run. Hide. Fight.

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Syllabus | **Lectures** | Resources

Data Visualization

Course Outline and Readings

C#	Date	Topics	Handouts/Deadlines
0		Setting Up RStudio	<i>Handouts</i> » Tutorial 0
1	Jan. 23	Data Visualization Ur-Text and Starting R Reading » Tufte, Part 1 » Chang Chapter 1, Chapter 15:1-15:7, 15:15-15:18	<i>Handouts</i> » Lecture notes » Tutorial 1 » Policy brief proposal » Fully composed chart » Good/bad/ugly
2	Jan. 30	Intro to Nuts and Bolts of Visualization and Data Prep in R Reading » Few, Chapters 3 and 5 » Tuva's Graph Choice Chart	<i>Due</i> » Tutorial 1 <i>Handouts</i> » Tutorial 2 » Lecture notes
3	Feb. 6	Levels and Shares, Bars and Lollipops Reading » Few, Chapters 9 and Chapter 10, pages 210-217 (on bars) » Chang, Chapter 3 » McGinty, “ Grasping Giant Numbers is Far From Second Nature ”, <i>Wall Street Journal</i> » Great lollipop from Wall Street Journal here . Full article is “ In Triumph or Tragedy, View of Trump ”	<i>Due</i> » Tutorial 2 » Policy brief proposal <i>Handouts</i> » Tutorial 3 » Lecture notes

Don't Waver", *Wall Street Journal*4 Feb. 13 **Histograms and Distributions***Due*

Reading

- » Few, Chapter 6
- » Chang, Chapter 6 (through 6.5)
- » Merrill and Leatherby, "**Here's How America Uses Its Land**"

» Tutorial 3

Handouts

- » Tutorial 4
- » Lecture notes

Feb. 20 Presidents Day

5 Feb. 27 **Maps I and Data via API***Due*

Reading

- » Monmonier, *Mapping it Out*, Chapters 1 and 2
- » Great dot density from *Post* [here](#); if you can't get the full article, the picture of goats is [here](#)

» Fully Composed Chart

» Tutorial 4

Handouts

- » Tutorial 5
- » Lecture notes

6 March **Functions and Storyboarding***Due*

6 Reading

- » Knaflic, Chapters 7 and 8

» Tutorial 5

Handouts

- » Tutorial 6
- » Lecture notes
- » In-class workshop instructions

Mar. Spring Break

13

7 Mar. **Maps II and Themes***Due*

20 Reading

- » Monmonier, *Mapping it Out*, Chapter 6
- » Takenaga, "**How the Times Makes Those Addictive Election Maps**", *New York Times*
- » Chang, Chapter 9: 9.2 to 9.6

» Tutorial 6

Handouts

- » Tutorial 7
- » Lecture notes

8 Mar. **Line charts and Annotations***Due*

27 Reading

- » Few, Chapter 10, pages 217-220 (on lines) and Chapter 13

» Tutorial 7

Handouts

» Tutorial 8

» Chang, Chapter 4 and Chapter 7

» Lecture notes

» Final presentation and paper instructions

9 April 3 **Guest speaker and In-class workshop**

Due

» [Kate Rabinowitz](#), Graphics Editor, *Washington Post*
» In-class workshop

» Tutorial 8
» Materials to your classmates for in-class workshop

Handouts

» Lecture notes

10 April **Scatter plots and Color**

Handouts

10 Reading

» Tutorial 9

» Friendly and Denis, “The Early Origins and Development of the Scatterplot”, *Journal of the History of the Behavioral Sciences*, 2005. [\[link\]](#) (skim is sufficient)

» Lecture notes

» Few, Chapter 10, pages 206-210 (on scatters) and Chapter 11

» Chang, Chapter 5

11 April **Student Consultations**

17 » No in person class

» Instead, consultations the week prior; sign up is coming

12 April **Storytelling, Accessibility and Interactivity**

Due

24 Reading

» Tutorial 9

» Knaflic, Chapter 9

Handouts

» Few, Chapter 10, pages 224-246 (secondary component design)

» Tutorial 10

» On [minimal reproducible examples](#), and a [specific R case](#)

» Lecture notes

13 May 1 Presentations and feedback

Due

» Presentations

» Tutorial 10

14 **Wed.** Presentations and feedback

May 3 » Presentations

Mon.,

May 8

Due

» Policy brief

Good, Bad and Ugly Assignment

- » Presenters and Commenters list coming here
- » Finders must
 - » link a graphic on the sheet by the Wednesday noon following the lecture
- » Commenters must
 - » come prepared with three specific points
 - » these can be criticisms, appreciations, or suggestions
 - » criticisms are best paired with suggestions
- » Each student is a presenter once and a commenter once