**GEORGETOWN UNIVERSITY**
**McCOURT SCHOOL OF PUBLIC POLICY**
**PPOL 646-01: DATA VISUALIZATION (THURSDAY SECTION)**
**Spring 2023**
**Prof. Wesley Joe, Email: joew@georgetown.edu**
**Office Hours on Zoom: Fridays, 12:00 p.m. – 2:00 p.m. and by appointment**
**To schedule an appointment, please use this link to my Google calendar.**

This course is a "hands-on" introduction to using visualization methods to discover insights from data and to communicate data-grounded insights to a variety of audiences. Students will learn how to create data visualizations with some widely used tools, and to evaluate visualizations that others produce. After completing the course, students should:

- Understand the major uses of data visualization for policy professionals

- Know the basic principles of the visual perception process and how they inform data visualization choices.

- Be able to determine which types of visualizations are appropriate for a given analytical or communication task.

- Be able to evaluate data visualizations according to evidence-based functional criteria as well as aesthetic considerations.

- Be able to produce a variety of types of visualizations using widely used software, including some core packages of R, Tableau, and other tools.

- Be able to use contextual information, such as captions and labels, to assure the graphic integrity of a data visualization.

- Evaluate the graphical integrity of a data visualization.

- Be able to refine your visualizations for presentation to both professionally-trained colleagues and untrained citizen-consumers of quantitative information.

## *PREREQUISITES*

The prerequisite for this course is Pre-requisites: PPOL 501 (Quant I) or PPOL 531 (Quant I) or PPOL 552 (Research Methods). No prior coursework or experience in computer programming is assumed. You should, however, have mastered the coding practices required for using Stata in the prerequisite class.

## *COURSE MATERIALS*

The following book is recommended (but not required) for this course:

- Dona M. Wong, 2013. *The Wall Street Journal Guide to Information Graphics*. W.W. Norton.

The following software packages are required for this course:

- Microsoft Excel

- R, from the R Project for Statistical Computing.  Available free of charge here.  Please install this before you install RStudio.

- RStudio Desktop, an integrated development environment.  Available free of charge here.

- Tableau Desktop. A powerful package for creating interactive visualizations that you can incorporate into blogs and other web sites. GU students can obtain a twelve-month license for Tableau Desktop free of charge here. (Consider waiting until the first week of April to install Tableau.)

**Important**: Please install these software packages on your computer's local drive, such as a hard drive or a solid state drive.  If you install the packages on a cloud drive, such as an iCloud space or Microsoft's OneDrive, security features can create problems for the process of updating R packages.

You will also need to use Adobe Illustrator to refine graphics created in R and Tableau.  Illustrator is the powerful industry standard for graphics.  It is also expensive.  You have two options:

- Use Adobe Illustrator CC on one of the Gelardin New Media Center computers.  The center has more than two dozen Windows and Macintosh computers with Illustrator.

- Purchase your own license for Adobe Illustrator CC.  Individuals can purchase a monthly subscription for $31.49 per month.  The link for this option is here.  Go to "Illustrator" **and select "Monthly plan", as shown next:**
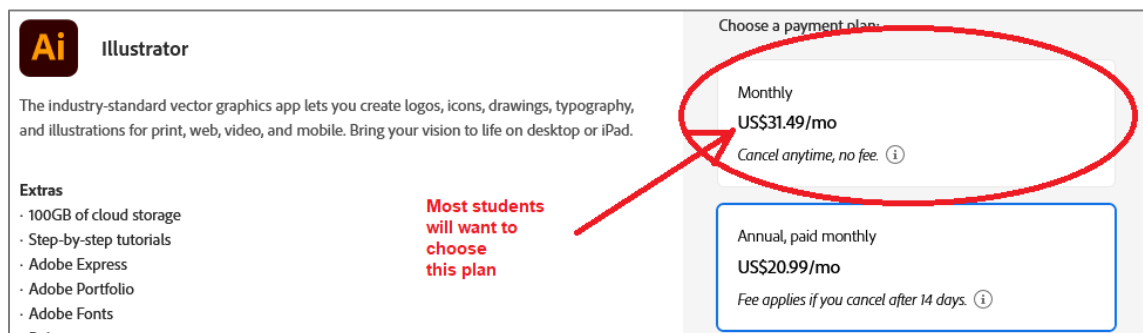


Alternatively, you can purchase a 12-month license for $20.99 per month, you get Illustrator as part of the complete Adobe Creator Cloud "Student and Teacher Edition" suite for that price. **Please note that the $20.99 monthly cost requires a 12-month commitment.**  It's a good deal, **if you plan to use that software for 12 months**.

## COURSE REQUIREMENTS

*"For the things we have to learn before we can do them, we learn by doing them."*
-- Aristotle, *Nicomachean Ethics*

The analytical and technical skills learned in this class are acquired mostly through regular *use*. Hence, the course requirements are heavy on *doing*. Your final grade will be based on the following:

- Portfolio Proposal (0%): Due January 30 at 11:59 p.m.
- Interim Project Submissions (6 total, 7.5% each; total 45%):
  - Interim Submission 1 (one replication and one original visualization), due February 6 at 11:59 p.m.
  - Interim Submission 2 (one replication and one original visualization), due February 20 at 11:59 p.m.
  - Interim Submission 3 (two original visualizations), due March 15 at 11:59 p.m.
  - Interim Submission 4 (two original visualizations), due March 27 at 11:59 p.m.
  - Interim Submission 5 (two original visualizations), due April 14 at 11:59 p.m.
  - Interim Submission 6 (two original visualizations), due April 27 at 11:59 p.m.
- Snapshot of work in progress submitted to members of your peer review group, due April 20 at 11:59 p.m. (0%)
- Data visualization story (15%): (minimum of three original visualizations that are not from previous interim submissions), due May 10 at 11:59 p.m.
- Final Portfolio (30%): Due May 10 at 11:59 p.m.
- In-class participation (10%).

Work that is turned in late without advance discussion with me will lose one-half letter grade per day late, including weekends and holidays. I will post further details of each assignment on Canvas.

## FINAL PORTFOLIO

Your final portfolio is the culmination of your work for this course. The portfolio will consist of revised original visualizations (that is, not the replications) that you submitted for your interim visualization assignments or your Data Story assignment for this class.

The final portfolio should contain **between 10 and 12 original, polished visualizations** that address the public policy issue (e.g. renewable energy, K-12 education, criminal justice) discussed in your portfolio proposal. The portfolio must include at least 8 original visualizations created in R, and one interactive visualization created in Tableau. Each visualization should be polished and complete. The entire portfolio, except any interactive Tableau visualization(s), should be submitted as a single PDF document.

Additional specifications and requirements of the portfolio assignment, including the submission procedure, and the peer feedback session will be available on Canvas.

## *USE OF ELECTRONIC DEVICES IN CLASS*

Technology can provide enormous help to learners. Sometimes, however, it can hinder learning. During class, please write your notes by hand. Please reserve computer use for in-class coding exercises/challenges.  Please avoid using a smartphone during class. Much peer-reviewed published evidence indicates that a policy like this enables you and your colleagues to learn more in class. See, for example:

https://www.chronicle.com/blogs/wiredcampus/taking-notes-by-hand-benefits-recall-researchers-find/51411

http://journals.sagepub.com/doi/abs/10.1177/0956797614524581

https://www.sciencedirect.com/science/article/pii/S0360131512002254

https://www.theguardian.com/education/2016/may/11/students-who-use-digital-devices-in-class-perform-worse-in-exams

## *OUTLINE OF THE COURSE*

What follows is an outline of the course content. Note that I reserve the right to adjust the reading selections and/or schedule after I learn more about the interests and backgrounds of the students in the class.

I.  ***JANUARY 12:  INTRODUCTION:  WHY VISUALIZE DATA?***

- Anthony Unwin, 2015. *Graphical Data Analysis with R*, chapter 1. (Available online from the Lauinger Library web site; ignore the R code for now.)

- Alberto Cairo. 2016. *The Truthful Art*, Introduction and chapter 1. (Available online from the Lauinger Library web site.)

- A. V. Pandey, A. Manivannan, O. Nov, M. Satterthwaite and E. Bertini. (2014). "The Persuasive Power of Data Visualization," in *IEEE Transactions on Visualization and Computer Graphics*, Vol. 20, No. 12, pp. 2211-2220. (Available online from the Lauinger Library web site.)

- Brendan Nyhan and Jason Reifler. (2019). "The Roles of Information Deficits and Identity Threat in the Prevalence of Misperceptions," *Journal of Elections, Public Opinion and Parties*, Vol. 29, No. 2, pp. 222-244. (On Canvas.)

II.  ***JANUARY 19:  ELEMENTS OF DATA VISUALIZATION; WHAT MAKES A GOOD DATA VIZ?***

- Nathan Yau. 2013. *Data Points*, chapter 3. (Available online from the Lauinger Library web site.)

- Stephen Few, 2009. *Now You See It*, chapter 3. (Available on Canvas).

- Alberto Cairo. 2016. *The Truthful Art*, chapter 2. (Available online from the Lauinger Library web site.)

- Jock Mackinlay. 1986. "Automating the Design of Graphical Presentations of Relational Information." *Association for Computing Machinery Transactions in Graphics*, Vol. 5, No. 2 (April), pp. 110-141. (Available on Canvas.)

III. ***JANUARY 26: INTRODUCTION TO THE GRAMMAR OF GRAPHICS AND GGPLOT2***

- Hadley Wickham and Garrett Grolemund, *R for Data Science*, sections 3.1 – 3.4, 3.6.

IV. ***FEBRUARY 2: GETTING YOUR DATA INTO ANALYZABLE FORM; REFINING FOR PRESENTATION (PART 1)***

- Wickham and Grolemund, *R for Data Science*, chapters 5, 12.1-12.3, and 28.

V. ***FEBRUARY 9:  UNIVARIATE DISTRIBUTIONS OF QUANTITATIVE DATA; REFINING FOR PRESENTATION (PART 2)***

- Anthony Unwin, 2015. *Graphical Data Analysis with R*, chapter 3.

- Wickham and Grolemund, *R for Data Science*, chapter 7.1-7.4.

- Dona M. Wong. 2013. *Wall St. Journal Guide to Information Graphics*, Introduction, chapter 1, and pp. 49-61. (Recommended.)

VI. ***FEBRUARY 16:  UNIVARIATE DISTRIBUTIONS OF CATEGORICAL DATA***

- Unwin, *Graphical Data Analysis with R*, chapter 4.

- Amelia McNamara and Nicholas J. Horton (2018). "Wrangling Categorical Data in R," *The American Statistician*, 72:1, 97-104. (Available online from the Lauinger Library web site.)

- Wickham and Grolemund, *R for Data Science*, chapter 15.

- Wong. *Wall St. Journal Guide to Information Graphics*, pp. 62-81.

VII. ***FEBRUARY 23:  VISUALIZING TIME SERIES DATA***

- Few, *Now You See It*, chapter 7. (Available on Canvas).

- Alberto Cairo, 2016. *The Truthful Art*, chapter 8. (Available on Canvas.)

- Wickham and Grolemund, *R for Data Science*, chapter 16.

VIII. ***MARCH 2:  VISUALIZING BIVARIATE RELATIONSHIPS***

- Unwin, *Graphical Data Analysis with R*, chapter 5.

- Wickham and Grolemund, *R for Data Science*, section 7.5.

- "Beware Spurious Correlations." *Harvard Business Review*. June 2015, pp. 34-35 (Available [here](.)

*MARCH 9: THURSDAY OF GU SPRING BREAK (NO CLASS MEETING)*

IX. **MARCH 16: MULTIVARIATE DATA; GRAPHICAL INTEGRITY**

- Edward Tufte, 2001. *The Visual Display of Quantitative Data*, chapter 2. (Available on Canvas.)

- David Eads. "Too Many Politicians Misuse and Abuse Crime Data." *The New York Times*, August 10, 2018. Available online: https://www.nytimes.com/2018/08/10/opinion/politics/giuliani-trump-chicago-data-crime.html

X. **MARCH 23: BEYOND GGPLOT2: SPECIALIZED PACKAGES; TELLING DATA STORIES**

- (Handout readings on Canvas.)

XI. **MARCH 30: INTERACTIVE VISUALIZATION ENVIRONMENTS**

- (Handout readings on Canvas.)

*APRIL 6: THURSDAY OF GU EASTER BREAK (NO CLASS MEETING)*

XII. **APRIL 13: GEOSPATIAL VISUALIZATIONS**

- Claus Wilke. 2019. *Fundamentals of Data Visualization*, chapter 15. (Available on Canvas.)

XIII. **APRIL 20: INTERACTIVE VISUALIZATION ENVIRONMENTS II**

- (Handout readings on Canvas.)

XIV. **APRIL 27: PORTFOLIO PEER REVIEW**

Groups of students provide peer feedback on each others' portfolio work in progress. Details of the review session structure and expected outcomes will be available on Canvas.

## ADDITIONAL UNIVERSITY ADMINISTRATIVE INFORMATION

I. **ACADEMIC RESOURCE CENTER/DISABILITY SUPPORT**

If you believe you have a disability, contact the Academic Resource Center (arc@georgetown.edu) for further information. The Center is located in the Leavey Center, Suite 335 (202-687-8354). The Academic Resource Center is the campus office responsible for reviewing documentation provided by students with disabilities and for determining reasonable accommodations in accordance with the Americans with Disabilities Act (ASA) and University policies. For more information, go to http://academicsupport.georgetown.edu/disability/.

## II. IMPORTANT ACADEMIC POLICIES AND ACADEMIC INTEGRITY

McCourt School students are expected to uphold the academic policies set forth by Georgetown University and the Graduate School of Arts and Sciences. Students should therefore familiarize themselves with all the rules, regulations, and procedures relevant to their pursuit of a Graduate School degree. The policies are located at: http://grad.georgetown.edu/academics/policies/

## III. PROVOST'S POLICY ACCOMMODATING STUDENTS' RELIGIOUS OBSERVANCES

Georgetown University promotes respect for all religions. Any student who is unable to attend classes or to participate in any examination, presentation, or assignment on a given day because of the observance of a major religious holiday or related travel shall be excused and provided with the opportunity to make up, without unreasonable burden, any work that has been missed for this reason and shall not in any other way be penalized for the absence or rescheduled work. Students will remain responsible for all assigned work. Students should notify professors in writing at the beginning of the semester of religious observances that conflict with their classes. The Office of the Provost, in consultation with Campus Ministry and the Registrar, will publish, before classes begin for a given term, a list of major religious holidays likely to affect Georgetown students. The Provost and the Main Campus Executive Faculty encourage faculty to accommodate students whose bona fide religious observances in other ways impede normal participation in a course. Students who cannot be accommodated should discuss the matter with an advising dean.

## IV. STATEMENT ON SEXUAL MISCONDUCT

Georgetown University and its faculty are committed to supporting survivors and those impacted by sexual misconduct, which includes sexual assault, sexual harassment, relationship violence, and stalking. Georgetown requires faculty members, unless otherwise designated as confidential, to report all disclosures of sexual misconduct to the University Title IX Coordinator or a Deputy Title IX Coordinator. If you disclose an incident of sexual misconduct to a professor in or outside of the classroom (with the exception of disclosures in papers), that faculty member must report the incident to the Title IX Coordinator, or Deputy Title IX Coordinator. The coordinator will, in turn, reach out to the student to provide support, resources, and the option to meet. [Please note that the student is not required to meet with the Title IX coordinator.]. More information about reporting options and resources can be found on the Sexual Misconduct Website:https://sexualassault.georgetown.edu/resourcecenter.

If you would prefer to speak to someone confidentially, Georgetown has a number of fully confidential professional resources that can provide support and assistance. These resources include:

- Health Education Services for Sexual Assault Response and Prevention: confidential email sarp@georgetown.edu
- Counseling and Psychiatric Services (CAPS): 202.687.6985 or after hours, call (833) 960-3006 to reach Fonemed, a telehealth service; individuals may ask for the on-call CAPS clinician

More information about reporting options and resources can be found on the Sexual Misconduct Website. Who can help? Check here.


## V.    STATEMENT ON USE OF CLASS MATERIALS

(With thanks to Prof. Barbara Schone)

Increasingly, with the proliferation of certain websites, questions about the ownership of course materials have arisen (and Georgetown is actively working on policies to address these concerns).  I consider my syllabus, lectures, handouts, assignment prompts and grading rubrics to be my intellectual property.  I respectfully request that you refrain from sharing my materials in any electronic (or paper) format.  Sharing notes, on an occasional basis, with others in the class is fine as long as they are not posted.