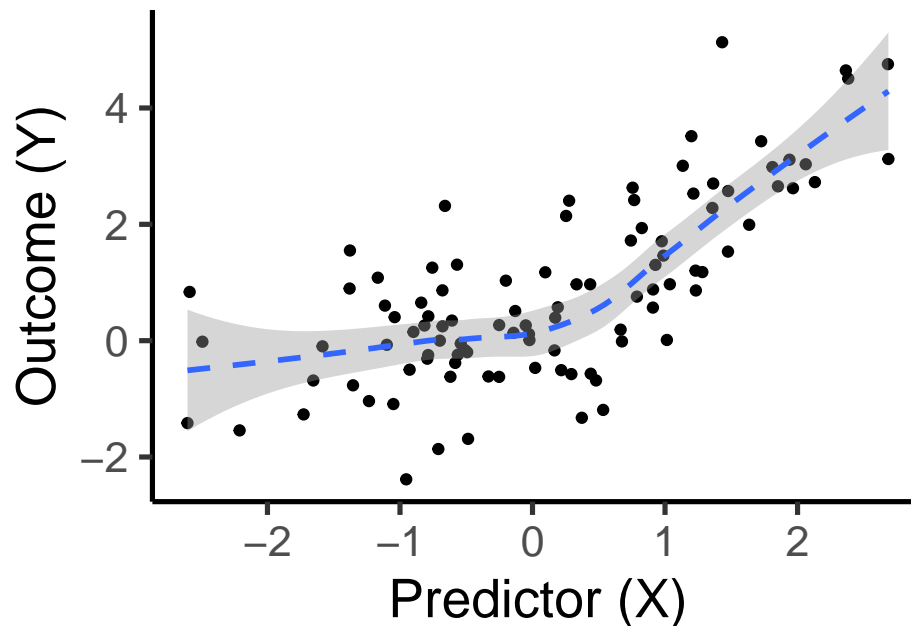# Statistical Graphics and Communication
Fall 2019 Syllabus

> The greatest value of a picture is when it forces us to notice what we never expected to see. — John Tukey

Statistical graphics play an important role in every step of research – from exploration to analysis to model checking to presentation and dissemination.

Creating quality statistical graphics is a critical aspect of research, but it is rarely emphasized or directly taught. This course will cover techniques for creating graphics at each stage of a research project, as well as more general techniques for communicating your research to different audiences (e.g., scientific researchers outside of your area / psychology, teachers, parents, policy makers, lawyers, business owners).

The primary focus of this course will be in **creating graphics**. As such, you will spend time learning software to create reproducible, publication-ready graphics.

Statistical Graphics and Communication

Course Information

- Statistical Graphics and Communication
- PSY5939 U04
- Thursday, 9:30am - 12:30pm
- PC 449

Instructor Information

- Stefany Coxe, Ph.D.
- Email: stefany.coxe@fiu.edu
- Office: DM 275
- Office Hours: By appointment – send me an email to schedule a time

Software

- R (using RStudio and RStudioCloud)
  - A major focus of this course will be creating and editing plots using **ggplot2** and creating reproducible documents using **markdown**
  - We will also discuss creating web-based applications and dashboards using **shiny** and animated plots using **plotly** and **gganimate**.

Canvas

Lecture notes, computer code, assignments, and other materials will be posted on Canvas before class. You should make sure they are available to you during class.

Text

Healy, K. (2018). Data Visualization: A Practical Introduction. Princeton University Press.

- Freely available at: http://socviz.co/

Assignments and grading

Homework (60%)

Four homework assignments covering some of the major topic areas of the course: (1) creating different kinds of plots, (2) modifying and tweaking plots, (3) exploratory data analysis and visual inference, and (4) model-based graphics. The assignments involve making plots and modifying them appropriately, describing your findings, and presenting the story of your data in a reproducible way using text and figures.

Project (25%)

You will propose a self-guided project that applies some of the skills we will develop this semester. Some possible options are: a Shiny app or interactive document, a reproducible manuscript including figures, an exploratory data analysis using graphics. More details to follow during the semester. The final project is due by December 13.

Presentation (10%)

A short presentation about your final project. This should be a reproducible slide set using R markdown. The main purpose of this presentation is to give you practice presenting your findings in a group setting and applying some of the science communication techniques we've discussed in class. Presentations will take place in class on December 5. Approximately 15 to 20 minutes per person, including questions.

Proposal (5%)

You will turn in a 1 to 2 page proposal for your project so that you can start to solidly form your ideas and get feedback and additional resources from me. The proposal is due by October 25.

Grade distribution

Percentage	Grade
>= 93.00:	A
90.00 - 92.99:	A-
87.00 - 89.99:	B+
83.00 - 86.99:	B
80.00 - 82.99:	B-
77.00 - 79.99:	C+
70.00 - 76.99:	C
<= 69.99:	F

Course and University Policies

Attendance

I shouldn't have to tell you to attend every class. This is graduate school. If you need to miss class for a good reason (such as illness, religious event, professional activity, or university-sanctioned event), please contact me as soon as possible to make any necessary arrangements. This is particularly important if you will miss class on December 5 (the date of the presentations).

Special Needs

Any student with a disability or other special need that may require special accommodations for this course should make this known to the instructor during the first week of class.

Information	Disability Resource Center
Website:	http://drc.fiu.edu
Email:	drcupgl@fiu.edu
Office:	Graham Center 190
Phone:	305-348-3532

Academic Misconduct

Students at Florida International University are expected to adhere to the highest standards of integrity in every aspect of their lives. Honesty in academic matters is part of this obligation. Academic integrity is the adherence to those special values regarding life and work in an academic community. Any act or omission by a student which violates this concept of academic integrity shall be defined as academic misconduct and shall be subject to the procedures and penalties set forth herein. All students are expected to adhere to a standard of academic conduct, which demonstrates respect for themselves, their fellow students, and the educational mission of the University. All students are deemed by the University to understand that if they are found responsible for academic misconduct, they will be subject to the Academic Misconduct procedures and sanctions, as outlined in the Student Handbook.

Academic Dishonesty

Please refer to your student handbook for a description of what constitutes academic dishonesty. I expect all students to complete and turn in their own work.

Tentative Course Outline

Date	Topics	Readings	Assignment due
August 29	Intro and history	Healy chapters 1, 2, 3	
September 5	ggplot intro	Healy chapters 4, 5	
September 12	Perception	Links on Canvas	Homework 1
September 19	All the plots	Links on Canvas	
September 26	ggplot themes, colors, etc	Healy chapter 8	
October 3	Exploratory data analysis	Links on Canvas	Homework 2
October 10	Visual inference	Cumming & Finch (2005)	
October 17	Communication	Lambert CARMA talk (Canvas)	Homework 3
October 24	Model-based graphics	McCabe, Kim, & King (2018)	Proposal
October 31	Model-based graphics	Healy chapter 6	
November 7	Interactive	TBD	Homework 4
November 14	Animation	TBD	
November 21	TBD		
November 28	HOLIDAY - no class		
December 5	Presentations		

Due dates subject to change due to hurricane, scheduling changes, or other reasons.

November 21 currently has no topic. We will use that day for make-up (in case of hurricane or because some topics end up taking more time), for another topic we all come up with between now and then, or as an extra lab day to work on your projects.

Final project due by the end of the day on Friday, December 13, 2019.

References

Webpages

Rstudio: http://rstudio.com

- Everything Rstudio, including the Tidyverse and Shiny.

Data Visualization Society: http://www.datavisualizationsociety.com/

- Cross-discipline group interested in all things visualization.

Five Thirty Eight: http://fivethirtyeight.com/

- Nate Silver's home. Covers a variety of topics related to statistics, politics, and sports. Great graphics, very approachable.

Mine Çetinkaya-Rundel's website: http://www2.stat.duke.edu/~mc301/

- Teaches statistics at Duke. Teaches at Rstudio and Data Camp. Heavily involved in statistics education.

Michael Friendly's website: http://datavis.ca/

- Quantitative psychologist with expertise in graphics.

Kaiser Fung's website, Junk Charts: http://junkcharts.typepad.com

- Business analytics. Claims to be "the Web's first data visualization critic."

Kieren Healy's website: http://kieranhealy.org/

- Quantitative sociologist.

Amelia McNamara's website: http://www.amelia.mn/index.html

- Teaches statistics at St. Thomas University. Involved in statistics education.

Edward Tufte's website: http://www.edwardtufte.com/tufte/

- Famous graphics writer. More about the design than the programming.

Nathan Yau's website, Flowing Data: https://flowingdata.com/

- Statistician and data visualization expert.

Articles and books

- Cumming, G., & Finch, S. (2005). Inference by eye: confidence intervals and how to read pictures of data. American Psychologist, 60(2), 170.

- Gelman, A., & Unwin, A. (2013). Infovis and statistical graphics: different goals, different looks. Journal of Computational and Graphical Statistics, 22(1), 2-28.

- Gordon, I., & Finch, S. (2015). Statistician heal thyself: have we lost the plot? Journal of Computational and Graphical Statistics, 24(4), 1210-1229.

- McCabe, C. J., Kim, D. S., & King, K. M. (2018). Improving present practices in the visual display of interactions. Advances in Methods and Practices in Psychological Science, 1(2), 147-165.

- Rahlf, T. (2017). Data Visualisation with R: 100 Examples. Springer.
  - Figures and links to code at: http://www.datavisualisation-r.com/

- Wainer, H. (1984). How to display data badly. The American Statistician, 38(2), 137-147.

- Wickham, H. (2010). A layered grammar of graphics. Journal of Computational and Graphical Statistics, 19(1), 3-28.

- Wickham, H. (2010). ggplot2: Elegant Graphics for Data Analysis. Springer.
  - You can download the PDF of this book through the FIU library / Springerlink.

- Wickham, H., & Grolemund, G. (2016). R for data science: import, tidy, transform, visualize, and model data. O'Reilly Media, Inc.
  - Free at: https://r4ds.had.co.nz/

- Wilkinson, L. (1999). Statistical methods in psychology journals: Guidelines and explanations. American psychologist, 54(8), 594.

- Wilkinson, L. (2005). The grammar of graphics. Springer-Verlag, New York, USA.
  - You can download the PDF of this book through the FIU library / Springerlink.

- Wilkinson, L. (2012). The grammar of graphics. In Handbook of Computational Statistics (pp. 375-414). Springer, Berlin, Heidelberg.

- Xie, Y., Allaire, J. J., & Grolemund, G. (2018). R markdown: The definitive guide. Chapman and Hall/CRC.
  - Free at: https://bookdown.org/yihui/rmarkdown/rmarkdown.pdf (PDF) or https://bookdown.org/yihui/rmarkdown/ (HTML)