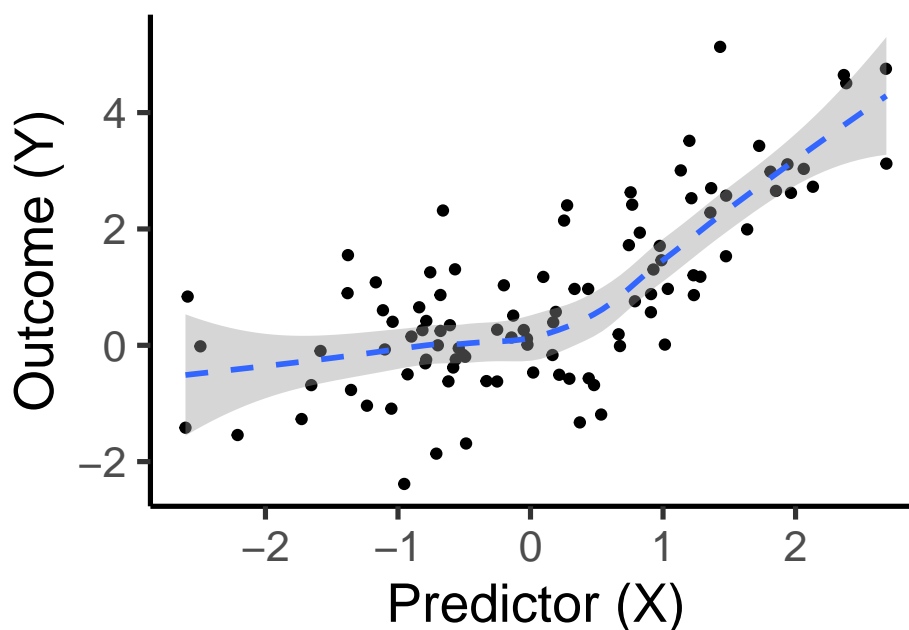


# Statistical Graphics and Communication

## Fall 2021 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).

## Course Information

- PSY5939 U03
- Thursday, 9:30am - 12:15pm
- Blue garage 120

## Instructor Information

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

## Learning objectives

- Create statistical graphics suitable for publication and/or presentation
- Enhance graphics by editing and modifying them
- Create reproducible reports
- Understand the cognitive underpinnings for good graphics
- Critique graphics produced in scientific journals and popular press
- Use graphics to help communicate scientific findings to scientist and non-scientist audiences
- Conduct an independent project involving techniques covered in the course

## Software

- R (using RStudio / 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

All course materials will be posted on Canvas.

## Text

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

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

## Assignments and grading

### Homework (4 assignments - 60% of grade)

Four homework assignments covering some of the major topic areas of the course: (1) R and R **markdown**, (2) creating, 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 in a **markdown** document using text and figures.

### Final Project (20% of grade)

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 including figures, a tutorial for an analysis or package using figures. As part of the project, you will *propose* the project, *present* it to your peers in a short presentation, and carry out a short *discussion* of your project and presentation with your peers.

### Proposal (5% of grade)

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.

### Presentation (10% of grade)

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. Approximately 15 to 20 minutes.

### Presentation discussion (5% of grade)

Each student should ask a question of at least 2 other students about their presentations. The original student should attempt to answer the questions. (Feel free to have further discussion as well!)

## Grade distribution

A	A-	B+	B	B-	C+	C	F
$\geq 93$	90 - 92.99	87 - 89.99	83 - 86.99	80 - 82.99	77 - 79.99	70 - 76.99	$\leq 69.99$

## Course and University Policies

### Attendance

I expect that you attend class sessions. 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. **Please do not come to class if you are ill.**

### 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.

- Website: <http://drc.fiu.edu>
- Email: [drcupgl@fiu.edu](mailto: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 26	Intro and history	Healy chapters 1, 2, 3	
September 2	R, <b>tidyverse</b> , <b>ggplot</b> intro	Links on Canvas	
September 9	1D and 2D plots	Healy chapters 4, 5	Homework 1
September 16	2D and 3D plots	Healy chapters 4, 5	
September 23	<b>ggplot</b> themes, colors, etc	Healy chapter 8	
September 30	Animation	Links on Canvas	Homework 2
October 7	EDA and Visual inference	Cumming & Finch (2005)	
October 14	Model-based graphics	McCabe, Kim, & King (2018)	Homework 3
October 21	Model-based graphics	Healy chapter 6	Proposal
October 28	Interactive	TBD	
November 4	Interactive	TBD	Homework 4
November 11	HOLIDAY - no class		
November 18	Communication	Lambert CARMA talk	
November 25	HOLIDAY - no class		
December 2	TBD		Presentations
December 9			Final Project

**Due dates subject to change** due to hurricane, scheduling changes, or other reasons. I will give you plenty of notice if this happens.

**Homework assignments due by end of day on Friday of week**

**Project proposal due by end of day on Friday, October 22, 2021**

**Presentation recording due by end of day on Friday, December 3, 2021**

**Project discussions should be complete by end of day on Monday, December 6, 2021**

**Final project due by the end of the day on Friday, December 10, 2021**

## References

### Webpages

**Rstudio:** <http://rstudio.com>

- Everything Rstudio, including the Tidyverse and Shiny.
- Cheatsheets for various packages, including **markdown** and **tidyverse**: <https://www.rstudio.com/resources/cheatsheets/>

**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)
- Xie, Y., Dervieux, C., & Riederer, E. (2020). *R Markdown cookbook*. Chapman and Hall/CRC.
  - Free at: <https://bookdown.org/yihui/rmarkdown-cookbook/>