EPPS6356 Data Visualization

Fall 2025 Wednesday: 7:00 pm – 9:45 pm GR3.402

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Office Hours:	Wednesday, Thursday: 2 pm – 4 pm, by appointment.
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Office Hours:	Tuesday 2:00 pm - 3:45 pm, Wednesday 5:00 pm -6:45 pm

Overview: This course trains students to design and critique data visualizations—from theoretical foundations (grammar of graphics, graphical perception, cognition) to AI-assisted visual analysis and communication. This is a coding-based course and students will learn to create data visualization by programming, and will learn to prototype, evaluate, and iterate visualizations with an emphasis on effectiveness, accuracy, ethics, and reproducibility. Deliverables include animated/interactive graphics, dashboards, and a team project.

Learning Objectives:

At completion of this course, students will be able to:

1. Explain and apply key theories to design data visualization.
2. Implement visualizations with codes for exploration and storytelling.
3. Evaluate visualization quality by developing protocols
4. Build and deploy interactive products (dashboards, explorable explanations) with reproducible pipelines.
5. Communicate insights with ethical guardrails

Required Reading:

Wilkinson, Leland. 2005. *The Grammar of Graphics. Second edition.* Springer (‡) (LW)
Murrell, Paul. 2016. *R graphics.* CRC Press.(‡) (PM)
Wickham, Hadley. *ggplot2: elegant graphics for data analysis.* springer, 2016. (*) (HW)
Cairo, Alberto. 2012. *The Functional Art: An introduction to information graphics and visualization.* New Riders. (‡) (AC1)
Cleveland, William S. and McGill, Robert. 1984. Graphical perception: Theory, experimentation, and application to the development of graphical methods. *Journal of the American statistical association*, *79*(387), pp.531-554. (CM)
Ware, Colin. 2012. *Information visualization: perception for design.* Elsevier. (‡) (CW)
Yau, Nathan. 2011. *Visualize This: The Flowingdata Guide To Design, Visualization, And Statistics.* John Wiley & Sons. (‡) (NY)
Unwin, Antony. 2015. *Graphical data analysis with R.* Vol. 27. CRC Press, (*) (AU)
Tamara Munzner. 2014. Visualization Analysis and Design. CRC Press. (‡)

(*) Online version available
(‡) Available electronically at UTD Library

Online reading:

Documentation
R
Shiny tutorial: http://shiny.rstudio.com
Quarto: https://quarto.org

Python
Seaborn documentation: https://seaborn.pydata.org/
Matplotlib documentation: https://matplotlib.org/

Notable Websites
Edward Tufte: https://www.edwardtufte.com/tufte/
Nathan Yau Flowing Data: https://flowingdata.com/
Alberto Cairo Functional Art: http://www.thefunctionalart.com

Recommended Reading:

Healy, Kieran. 2019. *Data Visualization: A Practical Introduction.* Princeton University Press (KH)

Beeley, C., 2013. *Web application development with R using Shiny.* Packt Publishing Ltd. (CB)

Cairo, Alberto, 2016. *The truthful art: Data, charts, and maps for communication.* New Riders. (AC2)

Chang, Winston. 2012. *R graphics cookbook: practical recipes for visualizing data.* O'Reilly Media, Inc. (‡) (WC)

Chen, Chun-houh, Wolfgang Karl Härdle, and Antony Unwin, eds. 2007. *Handbook of data visualization.* Springer Science & Business Media.

King, Gary, Michael Tomz, and Jason Wittenberg. 2000. "Making the Most of Statistical Analyses: Interpretation and Presentation." *American Journal of Political Science.* 44(2) 341-355.

Lanzetta, Vitor Bianchi. 2017. *R Data Visualization Recipes : a Cook Book with 65+ Data Visualization Recipes for Smarter Decision-Making.* 1st edition. Birmingham, England: Packt. (‡)

Andrew Gelman, Cristian Pasarica, Rahul Dodhia. 2002. "Let's practice what we preach: Turning tables into graphs." *The American Statistician.* 56:2(May): 121-130.

Jake Bowers and Katherine W. Drake. 2005. "EDA for HLM: Visualization when Probabilistic Inference Fails." *Political Analysis.* 13(4): 301-326.

Tremmel, Lothar. 1995. "The Visual Separability of Plotting Symbols in Scatterplots." *Journal of Computational and Graphical Statistics.* 4(2): 101-112.

Ben Fry. 2007. *Visualizing Data.* O'Reilly. (‡)

Tufte, Edward R. 2001. *The Visual Display of Quantitative Information.* Graphics Press. 2nd ed.

Cleveland, William S., 1985. *The elements of graphing data* (pp. 135-143). Monterey, CA: Wadsworth Advanced Books and Software.

Infographics

Wong, Donna. 2014. *Wall Street Journal Guide to Information Graphics*, Norton.

Time series data

Wills, Graham. 2011. *Visualizing time: Designing graphical representations for statistical data.* Springer Science & Business Media. (GW)

Lamigueiro, Oscar Perpinan. 2014. *Displaying Time Series, Spatial, and Space-Time Data with R.* Chapman & Hall/CRC.

Spatial data

Oyana, Tonny J. 2020. *Spatial analysis with r: statistics, visualization, and computational methods.* CRC press.

Lamigueiro, Oscar Perpinan. 2014. *Displaying Time Series, Spatial, and Space-Time Data with R.* Chapman & Hall/CRC.

JavaScript

Murray, Scott. 2017. *Interactive data visualization for the web: an introduction to designing with D3.* O'Reilly Media, Inc. (SM)

Campesato, Oswald. 2016. *D3.* Dulles, Virginia: Mercury Learning and Information.

APSA style manual (2018 edition):
https://connect.apsanet.org/stylemanual/

Participation: Full attendance of all classes is required and imperative. All class members have to actively participate in class preparation and discussion. Participation entails full preparation for class including research of class materials, completion of assignments and full involvement in the team project.   Only medical emergency (with documentation) is considered excused absence.   If you have a special medical condition, please contact me in first week and special arrangements can be made. Missing one class is equivalent to missing a chance of moving one letter grade up.

Assignments:

Exercises will be assigned. Students are expected to finish all assignments and publish products to own website. apply techniques to own work.   At beginning of each class, students will be selected to present and discuss assignment solutions.

Class Q&A: Use Teams for Frequently Asked Questions (Q&A)

Grading and Requirements:

Team Project:

Collaborative research is important part of this class. Each student must join a team composed of three members to work on a team project and final executive presentation. The final project must be between 25-30 pages in length. Originality is the first quality the instructor demands. Please read carefully this course's AI policy and the University's policy about cheating and plagiarism. Due dates of the proposal and progress reports are listed on the schedule below. No late submission will be accepted. Proposal of the project must be consulted with the instructor in advance and subject to the instructor's approval. It constitutes 20% of the final grade. The group project reports account for 30% of final grade. The final team project presentation is responsible for 30 percent of the final grade.

Each team must design and implement a data visualization project using the ***systems and techniques covered in class.*** Identify one original topic to investigate. Originality is the first quality the instructor demands. Original means the topic or data or method(s) must be originally designed and has never been published. Replication with new data and/or method does count but warrants strong justification (e.g. current project, dissertation research). NOTE: no Kaggle project/data replications.

Participation	10%
Assignment (posted on website)	10%
Project Proposal	20%
Final project presentation:	30%
Final project	30%

Document guideline:
All documents in this class must adhere to the following general guidelines:

- Submit electronic document to instructor's email in PDF format (~~NO Word or GoogleDoc~~):
  - With name and content on file name:
    - E.g. smith_proposal.pdf, doe_finalproject.pdf
  - On letter size paper
  - One inch on all margins
  - 12-point font
- NO submission using link to cloud or online drive (e.g. Google drive, box.com)
- Following the APSA style and format is **mandatory**
- Suggested image format: SVG or PNG

Schedule (Tentative)

Week	Topic	Due	Note
1	Introduction: Approaches of Data Visualization	Team building	
2	Data Theory, Grammar of Graphic		
3	Messages in data		Census day
4	Cognitive Science in Data Visualization		
5	Functionalism in Data Visualization		
6	R Graphics		
7	R ggplot2		
8	R Shiny	Proposal 10/15	
9	Building Dashboard	Presentation	
10	Data topic: Time Series Data		
11	Data topic: Spatial Data		
12	Data topic: Relationships and Models		
13	Special Topic: GenAI and Data Visualization		
14	*Fall break*		
15	Final Project Due		Fall break

AI policy

Generative AI is permitted in specific contexts and with acknowledgment
In this course, students shall give credit to AI tools whenever used, even if only to generate ideas rather than usable text or illustrations. When using AI tools on assignments, add an appendix showing (a) the entire exchange, highlighting the most relevant sections; (b) a description of precisely which AI tools were used (e.g. ChatGPT private subscription version or DALL-E free version), (c) an explanation of how the AI tools were used (e.g. to generate ideas, turns of phrase, elements of text, long stretches of text, lines of argument, pieces of evidence, maps of the conceptual territory, illustrations of key concepts, etc.); (d) an account of why AI tools were used (e.g. to save time, to surmount writer's block, to stimulate thinking, to handle mounting stress, to clarify prose, to translate text, to experiment for fun, etc.). Students shall not use AI tools during in-class examinations, or assignments unless explicitly permitted and instructed. Overall, AI tools should be used wisely and reflectively with an aim to deepen understanding of subject matter.

(adapted from the University of Texas at Austin Center for Teaching and Learning *ChatGPT and Generative AI Tools: Sample Syllabus Policy Statements*)

Comet Creed
This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same: "As a Comet, I pledge honesty, integrity, and service in all that I do."

Academic Support Resources

The information contained in the following link lists the University's academic support resources for all students. Please see http://go.utdallas.edu/academic-support-resources.

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus. Please review the catalog sections regarding the credit/no credit or pass/fail grading option and withdrawal from class.

Please go to http://go.utdallas.edu/syllabus-policies for these policies.
   The descriptions and timelines contained in this syllabus are subject to change at the discretion of the Professor.