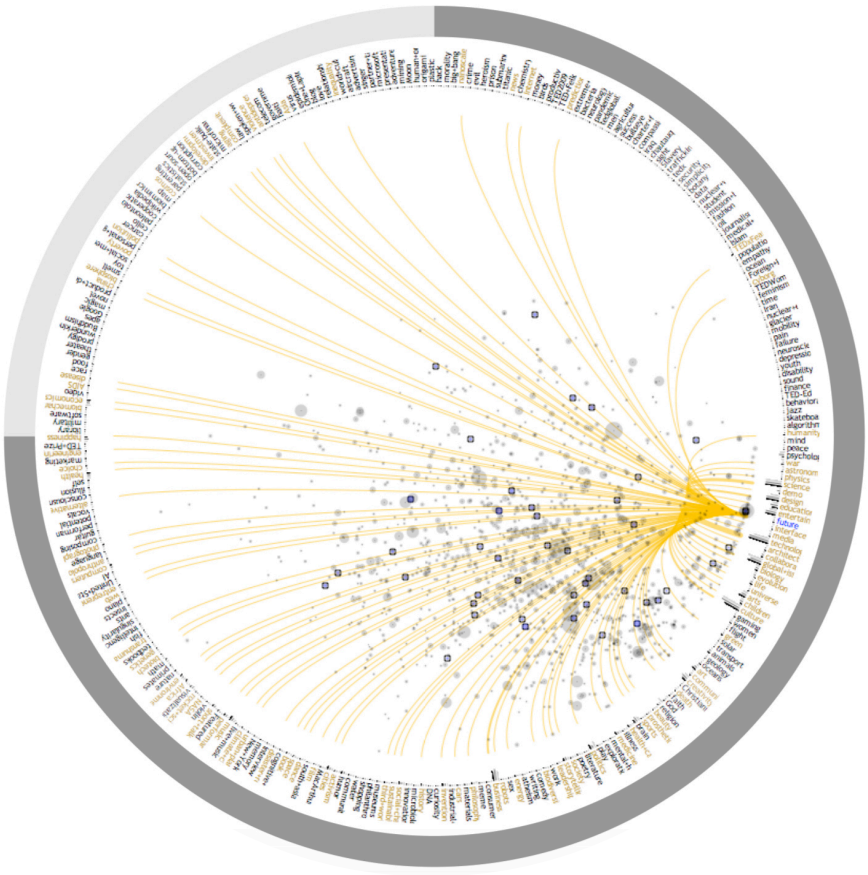
INTER-ACTIVE



DATA Science and Visualization

Spring 2025 Semester

Why sign up?

Data are essential to how we experience and understand the world. The way we interact with tools, analyses, and simulations all change the insights we learn, the stories we tell, the actions we take, who is included, and what is left out. This course combines traditional user experience and information design with interactive storytelling and video game design. We will emphasize practical techniques and technical skills needed to make both word-class data visualizations and interactive data science tools. More info online at https://interactivedatascience.courses.

Who is this for?

Scientists, engineers, designers, artists, journalists, and anyone else who wants to explore new methods for interactively and visually understanding, experiencing, and communicating data.

What we will do together?

Explore data visualization theory and fundamentals before studying cutting edge work in interactive data science.

Learn practical career-building technologies for building both static interactive data experiences through hands-on portfolio-building activities.

Examine existing powerful and informative interactive experiences including data visualizations and other interactive media like video games.

What you will be able to do after?

Build data visualizations and other interactive experiences to share your data findings with others.

Invite your audience in as co-creators to build new meaning alongside you in your work.

Craft digital tools which help both you and your users navigate data-heavy tasks and uncover insights.

Tell impactful stories that engage your readers emotionally through data.

Incorporate ethics and accessibility into your work.

Overview

Schedule

In-person. Monday / Wednesday 3 - 4 pm. Shires Hall #211. Office hours to be announced.

Prerequisites

Prior introduction to Python or JavaScript (course or self-taught). Grad or undergrad (soph or later).

Technical Skills Taught

Sketchingpy, P5, and D3. Will also provide optional brief Python and JavaScript / HTML / CSS instruction.

Theoretical Skills Taught

Information design, video game design, evaluative methods, human visual perception, accessibility.

Class Format

2 credit hours. 2 meeting / week. Hands-on activities, final mastery project, original lectures, discussion, hands-on skills labs, and guest lectures over 7 short modules.

Additional Resources

Includes complementary short reading / videos and supportive technology skills labs. The interactive experience will be your choice of either a video game or interactive data visualization.

Activities

Given each lecture as described below. 54% small projects, 12% interactive experience reflection, 35% final project intended to build mastery.

Grading

Pass / fail. Scores provided for each small project, final project, and the interactive experience reflection. See details (final page) for more information.

Instructor

Hello! My name is Sam Pottinger. I am a Senior Research Software Engineer / Data Scientist at UC Berkeley's Schmidt Center for Data Science and Environment. I've previously worked at Google, Apple, two start ups, and global design firm IDEO. I offer over a decade of data visualization / interactive science experience. My research at Berkeley blends information design, video game design, and ML / AI, and public policy for environment.

1. Hello

Begin with an initial exploration of key ideas.

We will start our journey together by motivating why data visualization is useful, what interactive science can offer, and take an early look at some of the foundational ideas that we will explore together throughout the rest of the course. We will also make sure everyone has what they need to do some upcoming activities with two optional skills labs.

Day	Reading / Watching	Classroom Material	Activity
Hello Visualization			
1	None	4 perspectives on data visualization.	None.
Hello Examples			
2	Media for Thinking the Unthinkable (Victor 2013)	Trying out the 4 perspectives on 4 examples.	Async introductions.
Hello Creative Python (Skills Lab)			
3	Dealing with Open Source Licenses (Winslow 2019)	Skills lab on creative coding in Python with basic concepts introduced.	Example visualization from your daily life.
Hello Creative Objects (Skills Lab)			
4	A Byte of Python (Swaroop 2023)	Skills lab on software architecture for creative coding in Python.	Revisit the example from the 4 perspectives lens.

2. Primitives

Study of the essential building blocks for data visualization.

We will transition to the foundational building blocks of data visualization and explore the cognitive science underpinnings behind effective information design. Using what many call the grammar of graphics, we will also have our first small projects that begin to offer hands-on experiences to build custom graphics with code.

Day	Reading / Watching	Classroom Material	Activity
Visualization as Design			
5	Review of Tufte's "The Visual Display of Quantitative Information" (LeRoy 2018)	Examples of problematic graphs (Tufte 2013), Chart junk (Tufte 2013), Tuftean axes (Tufte 2013), After Tufte (Elliot 2016	Critique a recent visualization in the news.
Visualization as Science			
6	Preattentive Attributes in Visualization (Kesavan 2016)	Stages of visual processing (Ware 2021), Visual working memory (Ware 2021, Preattentive features (Ware 2021), Gestalt / neg space (Portnow 2018)	Heat map of job satisfaction factors.
Sketching in Code (Skills Lab)			
7	Inventing on Principle (Victor 2012)	Stroke, fill, color (Ware 2021), primitive shapes, options for input, fonts.	Responsive art 1.
Sketching with Data (Skills Lab)			
8	None	Interactivity and event callbacks as well as basic data manipulation.	Responsive art 2.
Formalizing Glyphs			
9	How William Cleveland Turned Data Visualization Into a Science (Pricenomics 2016)	Revisit Clevland and McGill (1984), taxonomy of charts, concept of grammar of graphics (Wilkinson 2005).	Income inequality with 3 dimensions.

3. Combination

Understand common patterns and methods for making new ones.

Having built up the primitives used in data visualization, we pick up the pace to build sophisticated data graphics. After using existing chart types, we will venture into the great unknown by looking at how these lego pieces enable us to build completely new visual representations and how to test if novel approaches are successful.

Day	Reading / Watching	Classroom Material	Activity
Patterns			
10	The Web's secret stories (Harris 2007)	Sparklines, small multiples, and slopegraphs (Tufte 2013). Developer happiness (Pottinger 2019).	Income inequality with 5 dimensions.
Complex Types (Skills Lab)			
11	15 Views on a Node Link Graph (Munzner 2007). Why all world maps are wrong (Harris 2016).	Sankey, chord, arc, treemap, geographic data formats, projections. A look at Gephi and QGIS.	BART static visualization
Building new Visual Languages			
12	Lupi and Posavec (2015)	Movements (Harris and Kamvar 2015). Levels (Fry 2015). A dissection of Podcast Anthropology (Pottinger 2015).	Draw your last 5 years and your next 5 years by hand.
Measurement and Evaluation			
13	Designing for Realtime Spacecraft Operations (Binx 2016)	Quantitative (Munzner 2014), thinking-aloud (Lewis 1982), diary studies (Shniderman and Plaisant 2006), participatory desig (IxDF 2023), generalizable knoweldge vs quality assurance.	Think-Aloud of Pyafscgap (Pottinger and Zarpellon 2023).

4. Conversation

Consider and design for the reader's dialogue with your work.

Just short of half way through the course, you are already an expert at choosing from existing chart types and constructing your own novel visual representations. Next we look critically at the role of the reader to construct media which enable the reader to explore more freely and become a co-creator of knowledge.

Day	Reading / Watching	Classroom Material	Activity
The Reader as User			
14	It's Not You, Bad Doors are Everywhere (Posner et al 2016)	History of HCI (Duarte and Baranauskas 2016). Affordances (Norman 2013), working memory (Ware 2021), social actors (Nass et al 1994)	AFSC GAP
The Reader as Player			
15	The Role of the Player (Portnow 2011), Explorable Explanations (Victor 2011)	Why game design and its role, thinking and play, PLATO system (Bitzer et al). Ethos, pathos, logos.	Game or interactive viz analysis part 1*.
Ludonarrative			
16	The Last Guardian and the Language of Games (Brown 2017)	Bussed out visualization (Bremer and Wu 2017), Gun Deaths (Rees 2013), Parable of the Polygons (Hart and Case 2014).	Game or interactive viz analysis part 2*.
Architecture			
17	Super Mario Bros: Level 1-1 (Edmonds and Portnow 2014), Triangle Design (Brown 2023).	Loops (Brazie 2024), Hayashida level design (Pottinger and Zarpelleon 2023), Plastics (Pottinger et al 2024)	Game or interactive viz analysis part 3*.

*Visualization options available later. Video game options include Cosmic Wheel (Deconstructteam 2023), FTL (Ma and Davis 2012), Spiritfarer (Thunder Lotus 2020), Papers Please (Pope 2013), Unpacking (Brier et al 2021).

5. Context

Expand our understanding of the reader.

Now that we have a deeper understanding of how to think about the reader within our designs, we next zoom out to understand users as within a broader social and physical context. We will also consider visualization in a broader sense-making context.

Day	Reading / Watching	Classroom Material	Activity
Thinking Toys and Diegesis			
18	Storytelling with Verbs (Tremblay 2020). Spore, birth of a game (Wright 2007)	Possibility space (Wright 2003). Diegesis (Dassler and Portnow 2019). APH visualization (Pottinger et al 2024).	AFSC GAP part 2
Accessibility			
19	Games are for Everyone (Brown 2018)	WCAG (MDN 2024), common patterns, non-visual strategies.	[Final] Choose topic.
Ethics			
20	Here's What Ethical AI Really Means (Thorne 2023) or Sasha Costanza-Chock (2019)	User Centered Machine Learning (Pottinger 2019).	[Final] Initial designs.
Inquiry-Based Design			
21	The World Design of Metroid 1 and Zero Mission (Brown 2018)	Inquiry-based design (Hayes 2023), overview of datasets, journey mapping.	[Final] Initial design ideas.

6. Skills

Grow your technical tool chest.

You have gotten through some of the most important concepts in data visualization and interactive science. Now, we will explore different technical skills as you work on your final project. Note that guest lectures may move.

Day	Reading / Watching	Classroom Material	Activity
Panic at the Terminal (Skills Lab)			
22	None	Logistics for the final, preparing for larger or non-notebook code. Git, architecture patterns, iterative process.	[Final] Sketch in code.
Creative Code in JS (Skills Lab)			
23	None	P5 introduction.	[Final] Iterate for final.
Data Driven Documents (Skills Lab)			
24	None	D3 introduction.	[Final] Iterate for final.
Guest Lecture 1			
25	None	Career, creative, or technical perspective. To be announced.	[Final] Accessibility for final.
Guest Lecture 2			
26	None	Career, creative, or technical perspective. To be announced.	[Final] Ethics for final.

7. Mastery

Contribute to your portfolio.

The course ends with sharing final projects and a celebration of our time together.

Day	Reading / Watching	Classroom Material	Activity
Final Share Prep (Final Time)			
27	Final reading (see appendix)	Final projects and celebration.	[Final] Feedback

Details

Welcoming and Supportive Environment

I love this topic and I hope you will love it too! I am dedicated to your success within this course. All activities and projects should be an engaging avenue for collaboration focused on refinement of ideas in a hands-on but low pressure setting. We will be discussing big topics through design and artistic expression. By participating, we collectively promise to generously create a welcoming and supportive environment for exploration. Lectures will be hands-on so laptops and discussion encouraged. Class time ensures successful outcomes in the course and will provide key information about assignments. However, things happen. I trust you to use your time well so attendance will not be taken. There are no textbook or service fees and free options are available for the interactive experience if you do not wish to purchase a copy of a game.

How to Succeed and Pass the Course

Except day 1, each instruction day has an outside activity essential to course objectives and complementary to that day's discussion. I am excited to provide written individual feedback to help complement other course resources. Numerical scoring is not a focus of this course. However, for the purposes of pass / fail, each instructional day has an activity worth 10 points with two instruction days per week. 14 days have small projects which are generally short to complete, the interactive experience analysis spans 3 days, and the final project spans 9 days. For each 10 point grading, 3 points are given for completeness, 3 for reflecting course materials, 2 for technical correctness, and 2 for exploration / expression. 70% overall grade is required to pass (course is pass / fail).

Timely Response and Late Assignments

Being able to share timely feedback on activities enables projects to serve an important role in ensuring you get the most out of your time in the course. Therefore, activities are due at 5pm 2 days after their assignment except the final which is due altogether on May 14, 2025. Submissions must be made by May 1 if you want to receive pre-final feedback. Please talk to me if personal circumstances arise. Note that, automatically, there are no points deducted for 7 calendar days after assignment. However, 20% will be deducted each calendar day for late assignments starting at 5pm on the 8th day after assignment. All times are given in PT.

Student Feedback

Student feedback will be solicited at the end of each module to ensure the course is meeting its goals. Grades and submissions through university-provided LMS.

Contact

I work at Wellman Hall #201. Contact options available at interactivedatascience.courses. Small course without a TA.

Lab / Discussion

To fit the 2 credit hour format, labs will take place during course instruction time as indicated in the schedule.

Books

Reading to be provided. Students encouraged to purchase the interactive experience but alternatives provided.

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