Data Visualization for Architecture, Urbanism and the Humanities

- Columbia University | GSAPP and A&S | ARCHA4892 | Spring 2017
- Fridays 9am - 11am | Studio @ Butler
- Office hours: Mondays 10am - 12pm (previous email required)
- Professor: Juan Francisco Saldarriaga (jfs2118)
- Teaching Assistant: Buck Fivel (brw2103)

Course Overview

This course provides an introduction to data visualization theory and methods for students entirely new to the fields of computation and information design. Through a series of in-class exercises and take-home assignments, students will learn how to critically engage and produce interactive data visualization pieces that can serve as exploratory and analytical tools. The course is part of a larger initiative, hosted by the Center for Spatial Research (http://c4sr.columbia.edu/) to teach courses in the critical use of digital tools across fields in architecture, urbanism, and the humanities.

The course will be centered around a semester long data visualization group project, through which the students will learn the basics of data visualization, data analysis, data collection, programming and version control. However, even though the course will teach specific visualization tools, the main conceptual thread will be centered around how to work with data, both in the humanities and in architecture and urbanism. Students will define their final projects around their own interests, and will bring their own datasets into their final projects.

General Topics

- Data visualization history and concepts
- Working with data: collection and analysis
- Basic programming skills and web languages (HTML, CSS, Javascript)
- Interactivity and online data visualization
- Collaborative work and version control (GitHub)
- Working with text data
- APIs and Web-scraping

Evaluation and Grading
10% Class participation and discussion
20% Individual assignments and tutorials
15% Midterm presentation
20% Data visualization critique
35% Final project and final presentation and report

Resources and Materials

Course files, tutorials and presentations will be located on Courseworks, on the Center for Spatial Research (http://c4sr.columbia.edu/) website and on this repository.

The readings for the class will be duly uploaded to Courseworks. Similarly, students will be required to submit their assignments by uploading them to Courseworks. Finally, the class will also rely heavily on submissions to the blog. Students will be required to upload some of their own work as well as inspirational material, encouraging and developing a critical stance and visual skills.

Link to the blog (http://mapping2016fall.tumblr.com/) . ----Needs new Link----

Link to number of posts (https://docs.google.com/spreadsheets/d/106jrEOQ64bOK1pqhBBwC-z5eOU_4yphc7Fz0otWysI/edit?usp=sharing) . ----Needs new Link----

Schedule

Week 1: Introduction to course and setup
January 20

- Course administration and syllabus
- Overview of the course
- Assignments and final project
- Resources
- Why data visualization (discussion)
- Basic infrastructure (stack)
- Introduction to HTML and CSS
- Setup of local server

Week 2: Basic web concepts and GitHub
January 27

- Discussion: what is data in your field
- Version control basics
- Setup a GitHub repository
Setup a GitHub projects page

**Week 3: Data visualization matrix and basic programming concepts**

February 3

- Introduction to p5.js
- Introduction to JavaScript
- Console
- Basic programming exercises
- **Assignment 1 Due**: Matrix of data visualization and data types

**Week 4: Introduction to data visualization**

February 10

- Data visualization history, examples and theory
- Minard, Snow, Nightingale, Bertin, Tufte
- Programming exercises:
  - Variables
  - Loops
  - Conditionals

**Week 5: Presentations**

February 17

- In class presentations
- **Assignment 2 Due**: Detailed presentation of data visualization project

**Week 6: Contemporary data visualization & advanced programming**

February 24

- Contemporary concepts and examples of data visualization
- Basic data analysis concepts and techniques
- Programming exercises:
  - Functions
  - Objects

**Week 7: Working with text data**

March 3

- Working with text data: presentation by Michelle McSweeney
- **Assignment 3 Due**: Visualization of one dataset

**Week 8: Guest lecture - Giorgia Lupi**
March 10
- Guest lecture: Giorgia Lupi from Accurat

**Week 9: Spring Break (no class)**
March 17

**Week 10: Midterm review**
March 24

**Week 11: APIs**
March 31
- APIs and web-scraping techniques

**Week 12: Interactivity**
April 7
- Interactivity concepts and techniques
  - **Assignment 4 Due**: Data visualization critique

**Week 13: Work in class**
April 14
- Work in class

**Week 14: 3/4 Review**
April 21

**Week 15: Work in class**
April 28
- Work in class

**Week 16: Final review**
May 5
Assignment Schedule (Due Dates)

- **January 27:** Basic website hosted on GitHub
- **February 3:** Data and visualization matrix
- **February 17:** Data visualization project presentation
- **March 3:** One dataset visualization
- **March 24:** Midterm review
- **April 7:** Data visualization project critique
- **April 21:** 3/4 review
- **May 5:** Final review

References

Books

- Data Visualization:
  - *Data Flow: Visualizing Information in Graphic Design*
  - *Data Flow 2: Visualizing Information in Graphic Design*
  - *Data Points*, Nathan Yau
  - *Atlas of Shrinking Cities*, Beyer Elke
  - *Visualizing Information for Advocacy*, Tactical Technology Creative
  - *Design for Information*, Isabel Meirelles
  - *Semiology of Graphics*, Jacques Bertin
  - *Envisioning Information*, E. R. Tufte
  - *Visualization Analysis and Design*, Tamara Munzer
  - *Dear Data*, Giorgia Lupi, Stefanie Posavec
  - *Show Me the Numbers: Designing Tables and Graphs to Enlighten*, Stephen Few
  - *Information Visualization: Perception for Design*, Colin Ware
  - *The Functional Art: An Introduction to Information Graphics and Visualization*, Alberto Cairo

- Programming:
  - *Generative Design*, Hartmut Bohnacker, Benedikt Gross, Julia Laub, Claudius Lazzeroni
- *Eloquent JavaScript* (http://eloquentjavascript.net/), Marijn Haverbeke
- *HTML & CSS: Design and build websites*, Jon Duckett
- *Program or Be Programmed: Ten Commands for a Digital Age*, Douglas Rushkoff

- Typography:
  - *Thinking With Type*, Ellen Lupton

### Blogs & Websites

- Visualizing Data (http://www.visualisingdata.com/)
- Flowingdata (http://flowingdata.com)
- Periscopic (http://periscopic.com)
- Visualizing.org (http://visualizing.org)
- Accurat (http://accurat.it)
- Moritz Stefaner (http://truth-and-beauty.net/)
- Nocholas Felton (http://feltron.com)
- Infosthetics (http://infosthetics.com)
- Visualcomplexity (http://visualcomplexity.com)
- The Economist - Graphic Detail (http://www.economist.com/blogs/graphicdetail)
- Visualoop (http://visualoop.com/)
- Huffington Post (http://www.huffingtonpost.com/2014/12/22/huffpost-infographics-201_n_6351828.html)
- LA Times (http://graphics.latimes.com/2014-in-graphics/)
- Quartz (http://qz.com/318339/all-of-the-charts-we-made-in-2014/)
- Fathom (http://fathom.info/)
- Data Canvas (http://map.datacanvas.org/)
- Lapham's Quaterly Maps (http://www.laphamsquarterly.org/archive/maps)
- Lapham's Quaterly Charts and Graphs (http://www.laphamsquarterly.org/archive/charts-graphs)
- Territory (http://themapisnot.com/)
- Quartz Atlas Charts (https://www.theatlas.com/)
- Sensory Maps (http://sensorymaps.com/)
- Library of Congress ~ Maps (https://www.loc.gov/maps/collections/)
- The National Geologic Map Database (http://ngmdb.usgs.gov/ngmdb/ngmdb_home.html)

**Podcasts:**

- Data Stories (http://datastories.es/)
- PolicyViz (http://policyviz.com/the-policyviz-podcast/)

**Tools**

- Text editors:
  - SublimeText (https://www.sublimetext.com/)
  - TextWrangler (http://www.barebones.com/products/TextWrangler/)
- Python IDEs:
  - SublimeText (https://www.sublimetext.com/)
  - Anaconda (https://www.continuum.io/downloads)
  - Canopy (https://www.enthought.com/products/canopy/)
- Raw (http://raw.densitydesign.org/)
- Color:
  - Colorgorical (http://vrl.cs.brown.edu/color)
  - ColorHexa (http://www.colorhexa.com/)
  - ColorBrewer (http://colorbrewer2.org/#type=sequential&scheme=BuGn&n=3) ~ Mostly for maps but it's a good resource.
  - Adobe Color CC (https://color.adobe.com)
  - i want hue (http://tools.medialab.sciences-po.fr/iwanthue/)
  - Color Picker for Data (http://tristen.ca/hcl-picker/#/hlc/6/1/15534C/E2E062)
- Visualization toolkits:
  - D3 (https://d3js.org/) ~ a JavaScript library for manipulating documents based on data.
  - Vega (https://vega.github.io/vega/) ~ a declarative format for creating, saving, and sharing interactive visualization designs.
  - Vega-lite (https://vega.github.io/vega-lite/) ~ is a high-level visualization grammar. It provides a concise JSON syntax for supporting rapid generation of visualizations to support analysis.
  - Processing (https://processing.org/) ~ a flexible software sketchbook and a language for learning how to code within the context of the visual arts.
  - p5.js (http://p5js.org/) ~ a JavaScript library that starts with the same goal as
Processing, to make coding accessible for artists, designers, educators, and beginners, and reinterprets it for today’s web.

- **g9.js** ([http://omrelli.ug/g9/](http://omrelli.ug/g9/)) - automatic interactive graphs
- **Bamboo DiRT** ([http://dirtdirectory.org/](http://dirtdirectory.org/)) *Nearly comprehensive list of tools to use for DH projects*

**Text Analysis Tools**


**Data Cleaning Tools**


**Tutorials & Resources**

- **Codecademy** (multiple courses, HTML + CSS, Python, JavaScript, D3)
- **GitHub**:  
  - Introduction to Git ([https://sklise.com/2012/09/22/introduction-to-git/](https://sklise.com/2012/09/22/introduction-to-git/))  
  - Git workflow for beginners ([https://sklise.com/2012/10/07/git-workflow-beginner/](https://sklise.com/2012/10/07/git-workflow-beginner/))  
  - Try Git ([https://try.github.io/levels/1/challenges/1](https://try.github.io/levels/1/challenges/1))  
- **JavaScript**:  
  - Codecademy: JavaScript ([https://www.codecademy.com/learn/javascript](https://www.codecademy.com/learn/javascript))
Debugging:

- Chrome Debugging Tutorial (https://developer.chrome.com/extensions/tut_debugging)
- Firebug (http://www.developerfusion.com/article/139949/debugging-javascript-with-firebug/)

Color:

- How to Avoid Equidistant HSV Colors (http://vis4.net/blog/posts/avoid-equidistant-hsv-colors/)
- Your Friendly Guide to Colors in Data Visualization (https://lisacharlotterost.github.io/2016/04/22/Colors-for-DataVis/)
- How We Created Color Scales (https://datavisualization.ch/inside/how-we-created-color-scales/)

InfoVis Group (UBC Computer Science) – Visualization Design Resources (http://www.cs.ubc.ca/group/infovis/resources.shtml)

Datasets:

- Citibike Ridership Data (https://www.citibikenyc.com/system-data)
- Citibike Station Data – GBFS (General Bikeshare Feed Specification) (https://gbfs.citibikenyc.com/gbfs/gbfs.json) – And the documentation (https://github.com/NABSA/MBTA-GBFS/blob/master/gbfs.md)
- Citibike Station Feed – Legacy format (https://feeds.citibikenyc.com/stations/stations.json)
- Weather data – forecast.io API (https://developer.forecast.io/)
- Census data – American Fact Finder (http://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml)
- Census data – citysdk (https://uscensusbureau.github.io/citysdk/)
- World Bank data catalog (http://datacatalog.worldbank.org/)
- AWS Public Datasets (https://aws.amazon.com/datasets/)
- Campaign Finance Data (http://www.fec.gov/finance/disclosure/ftpdet.shtml#a2015_2016)
- Enigma.io (http://enigma.io/)
- Dreamtolearn – 1001 Datasets and Data repositories (Lists of lists of lists) (https://dreamtolearn.com/ryan/1001_datasets)
- Data is Plural (https://tinyletter.com/data-is-plural/archive?page=1&recs=10&sort=desc&q=)
- Visualising Data – Data Sources (http://www.visualisingdata.com/references/)
- Project Gutenberg (http://www.gutenberg.org/)
- Association of Religion Data Archives (http://www.thearda.com/)
- National Archive of Data on Arts and Culture (http://www.icpsr.umich.edu/icpsrweb/NADAC/)
- NYPL Labs Menus (http://menus.nypl.org/data)
- NYPL Digital Collections (http://digitalcollections.nypl.org/)
- The Data Visualisation Catalogue (www.datavizcatalogue.com)