Algorithms and Urbanisms

Wednesday, 9 am - 11 am.

Course Summary:
TLDR: Urban Data Analytics + Spatial Analysis + Data Visualization & Narratives + Speculative Futures of NYC + Impact of Disruptive Technologies + Cool Guest Lecturers

Modern disciplinary specialization has created a gap between data science and urbanism. Data science frequently attempts to standardize data collection and analysis across all urban environments including cities, suburbs, and rural areas. Urbanism, meanwhile, focuses on the particularities and complexities of cities on both a social and spatial level. The result is two methods of inquiry that have, historically, had little overlap. This course will explore the data/urbanism gap and will attempt to hybridize, spatialize, and subvert the two approaches of inquiry.

Students will work in teams to explore algorithmic methods and data visualization as a means of urbanistic analysis, communication, and speculations. Through data exploration, visualization and spatial analysis students will develop projects to investigate new methods of design, development and policy in New York City.

This course will introduce students to a range of data collection, exploration, analysis, and visualization techniques and work with course instructors to establish projects, develop workflows to exchange data, and test proposals. In developing the workflows, data analysis and visualization

we will work with and test a number of techniques and softwares, linking techniques the students are currently fluent in to new ones as needed for their projects.

Invited guests will come throughout the semester to present on a range of urban data centric topics and providing feedback on student projects. The range of guests is still being confirmed, but will likely include speakers from the Department of City Planning, the New York Times, Carto, and the Real Estate Board of New York.

Projects

This year we will take a different approach to the projects, instead of each team developing independent projects, we will explore projects through a single theme: How can we use the tools and techniques of this course to explore the potential impact and ethics of urban augmented reality / mixed reality and propose planning and policy for New York? (Those uninterested in this topic will be free to develop their own projects.)

As AR applications from games (Pokemon Go, Minecraft Earth) to advertising proliferate across cities will the technology outpace the city's ability to proactively plan for and regulate? (Think rise of Uber & Lyft out pacing taxis and cities ability to productively regulate.) From initial research this seems to be a relatively unexplored topic but one with the potential to greatly impact cities. For those interested in this topic we will work collectively but break apart aspects to research, explore and develop independently, or teams, all in the service of producing data-driven proposals for the proactive planning of the rise of urban AR.

This topic raises questions and potential conflicts well suited to explore using the techniques and structure of this course. For example, do people using AR apps navigate the city differently? Does urban AR change how we should approach urban design and planning? Given the recent examples of people trespassing on private property to get to PokeStops, using the techniques of this course can we predict where such conflict is likely to happen in New York? Should the physical landowner have any control of content being overlaid on their space? How about AR advertising on public spaces? For example, if Google Maps adds an AR feature for navigation that also overlays ads on buildings or public spaces should the property owners also profit or have control over the content?

For those not interested in the urban AR proposal, they will develop projects will be proposals to intervene in the process of city building, with teams of students creating speculative models informed by data and vetted through testing and their own disciplinary expertise. For example, what if every park had to pay for itself through the property tax from adjacent buildings? What densities does that require? What are the qualitative aspects of this development, both to maximize economic and social value creation, while mitigating potential negative externalities of dense development? How would you create the regulations that shape the new development? Were those assumptions responsible? What is an extreme outcome? How would the city change?

Course Goals

- Gaining literacy with urban data
- Understanding history of urban data visualization
- Learning techniques for collecting, analyzing, and visualizing data
- Constructing data driven narratives
- Utilizing collaborative models for policy, planning, and design
- Understanding the relationship between NYC zoning, development, and the built environment.

Technical Workflow

1. Data collection and creation
2. Data exploration
3. Build a model for how data analysis can influence urban design and/or policy
4. Use analysis to create a new dataset(s) particular to your model
5. Vet, benchmark, and groundtruth model
6. Create a narrative using data visualization
7. Use your data analysis to propose and test speculative futures for NYC

I understand students come from different backgrounds and have various technical skills. I will provide tutorials that will cover the technical workflow through a variety of softwares (e.g. QGIS, ArcGIS, Grasshopper, Excel, Python, web mapping) to both accommodate these differences as well as provide opportunity for acquiring new skills.

- Data collection, cleaning and merging: python, grasshopper, ArcGIS, QGIS or excel.
- API querying: Twitter and Flickr
- Spatial Analysis: ArcGIS, QGIS or Rhino/Grasshopper
- Web Mapping: MapBox.
- Visualization: ArcGIS, QGIS, or Rhino/Grasshopper.

Roles and Expectations

While we have established expectations (listed below) based on each students program, roles and techniques are fluid and can be shared between disciplines based on projects and team structures.

- Planners: urban data modeling
- Designers: spatial data analysis
- Developers: dynamic financial modeling

Course Structure

The course will start by learning the techniques of spatial analysis, data exploration, and visualization. Students will work with open data and unique datasets provided by the course instructors (such as 8 million geo-located tweets, comprehensive streeteasy data, and close to a million Google businesses). Students will conceive of a proposal to link these datasets with a particular policy, planning, or design goal in New York City. In addition, each team will generate one unique dataset particular to their goal through spatial analysis tools or API querying. This will require benchmarking and ground truthing to ensure the dataset has a useful relationship with

reality.

Next, the datasets will be used to create a model whereby data analysis can be used to directly inform how the student's particular policy, planning, or design goal is implemented in the urban environment. This will include identifying sites to test the model to understand it's impact the city and to calibrate performance based rules. Students will develop real proposals for how the city might approach new development in the future from cost and value creation, to infrastructure, to zoning and land use policy, to massing and urban form.

Resources & Schedule

Datasets

Techniques and Tutorials

- Week 1, January 22nd
- Week 2, January 30th
- Week 3, February 5th
- Week 4, February 12th
- Week 5, February 19th
- Week 6, February 26th
- Week 7, March 5th

Week 8, March 12th: Midterm

- Week 9, March 26th
- Week 10, April 2nd
- Week 11, April 9th
- Week 12, April 16th
- Week 13, April 23rd
- Week 14, April 30th: Final

Datasets

Open datasets

- Current PLUTO Data
- PLUTO Parsed by borough
- PLUTO Parsed by Community District
- NYC 3D models
- Department of Finance Sales Price Data
- 2014 Uber Data - Uber Movement Data
- 311 Complaint Data - Has 2010 to present as well as data for 2004 - 2009. 311 Complaint Types
- Building Energy Data - From 2011 - 2017
- Subway Station Locations
- Subway Entrance Locations
- Voting/Polling Sites
- Restaurant Inspection Results.
- DOB Job Application Filings -
- DOB Permits Issued - Job Status and Permit Type explanations
- DOB Stall Construction Sites -
- Citi Bike Data - Based on trips taken
- MTA Bus Stop Locations
- Perceived safety - Analysis of safety based on google street view
- DOF Tax Document Info, including rent stabilized Apartments and Here
- AirBnB Data
- Liquor Licenses
- Weather Data by Zip Code
- Inclusionary Housing Zones (shapefile) - Have to scroll down to find
- Housing Development and Preservation (HPD) data on affordable units
- Rent Stabilized Apartments - pdf by borough, should be able to copy and paste into excel.
- Other relevant datasets available at NYC Open Data

Custom Datasets

Must be signed into Lionmail account to download.

- Streeteasy Data
    - All data up to Fall 2016
    - Very large dataset. Unless you are going to use it, delete amenity description feature to make easier to work with.
- Transit Access, Daylight, & Landuse Diversity Data Set generated for this KPFui Paper
- NYC Twitter Data - 2015
- NYC Google Places Data - 2018
    - Shapefile and CSV

Techniques and Tutorials

If there is a tutorial that has not been posted yet, but you are interested, let me know and I'll prioritize it. I will be adding and updating tutorials throughout the semester. If one below is out of date, let me know and I'll update.

Data Warmup Part 1

- Exploring Data with Charts
    - This tutorial uses PLUTO data
    - Making scatter plots, histograms, bar charts, line charts and area charts. We'll use Excel's pivot chart feature which is an easy way to make charts.
    - Recommended Skills: none
    - Required Software: Excel

- Exploring Data with Thematic Maps (Complete either the ArcGIS version, or the Grasshopper version below)
    - ArcGIS:
        - This tutorial uses MapPLUTO data
        - Create choropleth maps using ArcMap and export to illustrator
        - Recommended Skills: none
        - Required Software: ArcMap
    - Shape Files into Grasshopper and Map Visualization in Grasshopper:
        - This tutorial uses MapPLUTO data (but use the MapPLUTO data parsed by borough that has been posted to this doc.)
        - Watch this Introduction to Grasshopper and Data Trees if you're new to grasshopper.
        - Importing shapefiles and filtering / exploration. How to import shape using the @it plug-in. Filtering, data exploration and data field calculation. (Make sure to go properties and unblock the file before unzipping.) Grasshopper Definition.
        - Recommended Skills: Rhino
        - Required Software: Rhino + Grasshopper

Data Warmup Part 2

- Attribute Creation and Table Joins
    - This tutorial will show you how to create a new attributes from existing attributes in the PLUTO dataset. We'll go over joining 2 datasets using a "table join". We'll end showing you how to bring this into ArcMAP.
    - Download polling sites data here.
    - Recommended Skills: none
    - Required Software: Excel

- Spatial Joins and Basic Geospatial Analysis (ArcGIS version, Grasshopper version)
    - We'll go over how to join 2 datasets with spatial joins. We'll also cover creating buffers to use for spatial joins. Choose either the ArcGIS version and Grasshopper version depending on what you're most comfortable with.
    - ArcGIS:
        - This tutorial will go over spatial joins based on proximity.
        - Download the subway location data here.
        - Recommended Skills: None
        - Required Software: ArcMap
    - Grasshopper:
        - Importing lat / long point data and join with PLUTO data.
        - Download the subway location data here, make sure to get the CSV file. Install GHowl (make sure to go properties and unblock the file before unzipping.) Rhino file, Grasshopper definition
        - Recommended Skills: Rhino
        - Required Software: Rhino + Grasshopper

Basic Skills

- Cleaning and Data Field Calculation
    - How to clean up datasets and make / add new data features, such as percent underbuilt.
    - Recommended Skills: none
    - Required Software: Excel

- Introduction to GIS
    - In this demonstration we will create a residential unit density map of Manhattan using New York City Tax Assessor data from the PLUTO dataset and geographic boundary data from NYC Planning. The map will produced in ArcGIS and exported.
      Skills: Creating a new map, adding data, basic symbology, basic labels, field calculator, layout, mapexport.
    - Tutorial Example Data
    - Recommended Skills: none
    - Required Software: ArcGIS

- Converting a CSV to Point Data
    - This tutorial covers how to take NYC Street Tree data in CSV format and convert it to a point shapefile in ArcMap. It will use the latitude and longitude values for each point that are present as attributes in the CSV.
    - Recommended Skills: none
    - Required Software: ArcGIS

- Making Hex Bins in ArcMap
    - This tutorial explains how to create equal area bins in Arcmap. Equal area bins are a great spatial unit to aggregate data to because you don't need to normalize your data over area. Specifically it uses hex bins, although you could also make square bins or triangular bins as well.
    - Recommended Skills: none
    - Required Software: ArcGIS

- Binning Point Data
    - Aggregate point data to hex bins so that you can compare disparate neighborhoods or areas with point density, or summary statistics of the points' attributes.
    - Go through this slide presentation on hex binning
    - Recommended Skills: watch *Converting CSV's to Point Data* and *Making Hex Bins in ArcMap* first
    - Required Software: ArcGIS

Economic Data Analysis

- Google Places: Data Scraping
    - This would involve making API calls to get Google Places data for a specific area. It wouldn't involve coding because I could prepare the script for students to use without too much effort. This could be turned into a Grasshopper tool to prevent the use of python and command line.
    - Recommended Skills: none (Python a plus)
    - Require Software: Python, Sublime Text

- Calculating Property Tax Revenue
    - Calculating property tax revenue can be a useful metric for measuring the impact of your proposed projects for session B. It may be that you have identified properties likely to develop under your proposal. Use this to calculate the new revenue from the additional area. Or, your proposal may increase the value of existing properties. Use this to determine the additional revenue from the increase in value.
    - Grasshopper definition for Calculating Property Tax Revenue and Market Rate Value from PLUTO data: Video (3.5 min) Definition
    - Recommend Skills: Math
    - Required Software: None

Social Data Analysis

- Collecting and Analyzing ACS/Census Data

    - The American Community Survey and Census provide a wealth of data about demographics, income, etc. This can be harnessed to inform public policy in the areas of zoning, land use, housing affordability, mobility, and development incentives. This tutorial explains how to join data from the website Social Explorer to block group shapefiles from the US Census.
    - Recommended Skills: ArcGIS
    - Required Software: ArcGIS

- Data Download and Joining, Summarization, and Expansion
    - This demonstration covers downloading data from American FactFinder and joining two datasets of varying geospatial reference. A previous tutorial covers a more basic example. We will download data and identify joining information, compose custom attribute fields, and resolve aggregation/distribution differences between two scales of data.
    - You will download your own data for this tutorial.
    - Recommended Skills: ArcGIS
    - Required Software: ArcGIS

- Twitter Data: Data Scraping
    - Extract data from the Twitter API using Mosquito for use in the Rhino environment. Required plugins: gHowl, and Mosquito. Before you install plugins, unblock the zip file or plugin by right clicking and going to properties. There should be an option to unblock in the lower right hand corner. Builds off of the Spatial Joins grasshopper tutorial
    - Grasshopper Definition
    - Rhino File
    - Recommended Skills: Rhino, Grasshopper
    - Required Software: Rhino, Grasshopper

Spatial Joins and Exploration

- Symbology, Analysis, and Custom Data
    - In this demonstration we will create a map that shows proximity of buildings to a service or amenity. In this hypothetical case, the task question will be “How many buildings are within walking distance to a public basketball court?” To answer this question and draw a map to show it, we will need to extract data from an existing dataset and compare it with another dataset.
      Skills: Selecting Features, Extracting Data, Joining and Relating Attributes, Spatial Analysis.
    - Tutorial Example Data
    - Recommended Skills: ArcGis
    - Required Software: ArcGis

Visualization

- Basemaps and Illustrator Export
    - This demonstration will add satellite basemaps to our ArcGIS maps and use it as a background. We will also export scale maps to illustrator for finishing.
      Skills: Satellite Imagery, Basemaps, Layout Export, Raster Export and Vector Export, Basic Compositing.
    - Tutorial Example Data
    - Recommended Skills: ArcGIS
    - Required Software: ArcGIS

- Removing Clipping Masks from Charts Exported from Excel to Illustrator
    - This is a very quick tutorial showing a trick for removing all of the clipping masks from charts exported from excel to illustrator.
    - Recommended Skills: None
    - Required Software: Excel, Illustrator

- Making a Treemap in Excel
    - Make a tree map of NYC's street tree data.
    - Download street tree data here
    - Recommended Skills: Excel
    - Required Software: Excel

- Finishing Maps in Photoshop and Illustrator
    - This demonstration will go over workflows to finish maps in Illustrator and Photoshop.
      Skills: Raster graphics, Vector graphics, Illustrator object properties and styles: Strokes, Fils, Masks, Compound Appearances, Photoshop, Blending Modes.
    - Tutorial Example Data
    - Recommended Skills: None
    - Required Software: Photoshop / Illustrator

- Visualization and Exporting Images
    - Builds off the importing shapefiles tutorial. How to do color gradients, text, and exporting high resolution images. Reduces the need for illustrator, photoshop and indesign work.
    - Grasshopper Definition
    - Completed Definition
    - Recommended Skills: Rhino, Grasshopper
    - Required Software: Rhino, Grasshopper

Environmental & Spatial Analysis

- Climate Analysis: Generate an annual comfort analysis for a specified weather file. Understand what impacts outdoor comfort and when (solar radiation vs wind.) Generate wind roses.
    - Grasshopper Definition
    - Recommended Skills: Rhino, Grasshopper
    - Required Software: Rhino, Grasshopper

- Average Daylight Hours: (Do the climate analysis tutorial first.) Calculate average daylight hours for a specified time range (hours during the day, days of the month, and months throughout the year.) Also, visualization and quantifies the impact of specific buildings relative to the overall context.
    - Grasshopper Definition
    - Rhino File
    - Recommended Skills: Rhino, Grasshopper
    - Required Software: Rhino, Grasshopper

- Urban Visibility Analysis - Tool for calculating the visibility between two sets of points. For example, streets and parks or public spaces and buildings.
    - Grasshopper Definition
    - Rhino File
    - Recommended Skills: Rhino, Grasshopper
    - Required Software: Rhino, Grasshopper

- Record Spatial Data - Definition for recording spatial analysis data to create a new data set. Uses average daylight hours as an example. Needs the Horster grasshopper plugin in. Also needs a weather file for the daylight hours analysis.
    - Grasshopper Definition
    - Rhino File
    - Recommended Skills: Rhino, Grasshopper
    - Required Software: Rhino, Grasshopper

Python and API's

- 1) Setting up Python
    - This tutorial shows you how to download and install Python on a Windows computer. (if you have a Mac python comes natively)
    - Recommended Skills: None
    - Required Software: Windows Computer

- 2) Intro to Python

    - This tutorial will go over the basics of python. Here is a link to the Jupyter Notebook file that you'll need for the tutorial.
    - Recommended Skills: None
    - Required Software: Anaconda, Jupyter Notebook (installed in the Setting up Python tutorial)

- 3) API Basics
    - Go over basic API concepts and introduce a basic workflow for using API's.
    - Links: API Slideshow, geojson.io, MapPLUTO
    - Recommended Skills: none
    - Required Software: Anaconda, Jupyter Notebook

- 4) Streaming from the Twitter API
    - Edit and run a python script that will stream geolocated Tweets from New York City.
    - Links: github repository with streamer, Twitter Developer
    - Recommended Skills: none
    - Required Software: Anaconda

Web Mapping

- 1) Introduction to Web Mapping with Kepler.gl
    - This tutorial will cover 2 common web mapping formats (CSV, geojson) using kepler.gl, an interactive mapping tool developed by Uber.
    - Recommended Skills: None
    - Required Software: None

Data Exploration, Visualization and Analysis

The first half of the course will focus on learning new techniques and using urban datasets for spatial analysis, data exploration & visualization, and initial spatialization of the proposal. Each team will select at least one additional dataset (either open or generated spatially) to include as part of their project. The additional dataset should flesh out the potential correlation between qualitative aspects of urban form and real estate value. Potential datasets include open datasets such as noise or taxi data, but also datasets that have been curated by the instructors, such as 8 million geo-located tweets and streeteasy data..

Week 1, January 22nd

Lecture: Introduction

The first two weeks will cover urban data fundamentals while introducing two key themes of the course, data visualization and crafting narratives.

Assignment:

1. Read the following articles:
    a. Million Dollar Blocks and the Architecture and Justice
    b. Rent Stabilized Housing is Disappearing Fast- Especially on the Upper East and Upper West Side
    c. Does Gentrification Cause a Reduction in Laundromats?
    d. What to Consider When Making Choropleth Maps
    e. Picking a Color Scale for Scientific Graphics

2. Familiarize yourself with the PLUTO Data Dictionary. PLUTO will be the primary dataset we use in this course.

3. Complete the Data Warmup Part 1 Tutorials
    a. Exploring Data with Charts Tutorial
    b. Exploring Data with Thematic Maps Tutorial

    > You have the option to take this tutorial in either ArcGIS or in Grasshopper. Only choose one depending on what you're more comfortable with. If you don't have experience in either, the ArcGIS version is probably going to be easier.

4. Create a Data Dashboard in Google Slides
    a. Use the data exploration techniques covered in the data warmup tutorial to explore an aspect of the Pluto Dataset that interests you. Ask a question of the data and then try to find and answer, or simply explore an anomaly that you find.
    b. Using at least 2 different chart types and one map, create a data dashboard that explains your question, or anomaly of interest.
    c. Add your data dashboard to this google google slides presentation. Include 2 to 4 additional slides to explain how you explored the data. Build a narrative around this exploration and what your findings were. **Post by Noon on Tuesday**

Week 2, January 30th

New York City Zoning, review initial exploration.

Lecture: NYC Zoning
Lecture: Table Joins and overview of assignment 2

Assignment:

1. Read the following articles:
    a. The Key Ingredient in Stop-and-Frisk Reform: Open Data
    b. Redlining is Alive and Well—and Evolving
    c. Here's What we Know about Trump's Mexico Wall
    d. Listen to the Crime Machine Part 1 and Part 2

2. Complete the Data Warmup Part 2 Tutorials

3. Fill out this survey. We'll use it to structure collaboration and distribute work.

4. Develop your data driven exploration and narrative
    a. Continue your week 1 exploration using the techniques from part 2 of the data warm up.
    b. Create a least one new data feature through either a data field calculation (like Built FAR / Max FAR to derive the percent built,) or through joining a dataset to the PLUTO data.
    c. Filter the data to drill down into your week 1 exploration.
    d. Update and add to your presentation from the previous week. Max 8 slides.

Week 3, February 5th

Guest Lecture: Amanda Doyle, Team Lead, Data Engineering at NYC Department of City Planning
Review Data Warm Up assignment

Assignment:

Urban AR research assignments. This is editable so feel free to add a focus if you have one and @ me with any questions. Have a quick meeting with those doing you same research topic to coordinate and divide work. News Items and Surveying and Testing should meet together.

Focus your research based on what will be useful for the trajectory of this course (data exploration & visualization, new data creation, and scenario based modeling) and your particular interests as indicated in the survey. Don't hesitate to reach out with questions.

1. Policy, Regulatory and Ethics Readings:
    a. Law, virtual reality, and augmented reality.
        i. Full paper: https://scholarship.law.upenn.edu/cgi/viewcontent.cgi?article=9622&context=penn_law_review
    b. How to begin regulating a digital reality world
    c. Augmented Reality Law, Privacy, and Ethics by Brian Wassom
    d. IEEE Announces Virtual Reality (VR) and Augmented Reality (AR) Standards Projects

2. News Items related to Urban AR (like trespassing)

3. AR Technology:
    a. Research and overview, AR vs MR, how they geolocate
    b. Mobile development kits

4. Survey & Testing of Urban AR Apps to understand use, interaction with the city and how we might model user patterns at an urban scale.
    a. Games: Pokemon GO, Minecraft Earth, Wizards Unite
    b. Google Maps AR, Google AR Experiments, Google Lens
    c. What else should we test?

Post your research summary & any initial project / data exploration ideas to this google slides presentation by noon on Tuesday.

Path 2 - Open Project

1. Peruse the urban projects linked to below. Using data, how would you approach these projects? Include your responses on these in your initial project proposals
    a. 9 Top Architects Share Their Dream Projects to Improve (or Save) New York City
    b. Urban Design Forum's Mobility Proposals
    c. Top 10 Transportation Proposals That Would Transform New York City

2. Create your team! Let me know by the end of the week who your team members are. Teams should be 2-4 people, if you want to work alone, reach out to me to discuss.

3. With your team, establish two potential project ideas (it can and will likely change over the semester) and define rough roles for each team member, for example: data research, cleaning and processing, data exploration and analysis, spatial analysis and filtering, creating spatial fields, investigating results, related work research. Create a data driven narrative to set up your proposal for NYC (to be developed in the second half of the course) through data exploration, analysis and mapping. It can be a useful exercise to pose potential ideas as "What If?" questions. For example: What if all parks in NYC paid for their themselves? What if development had to retreat from flood zones?

4. Post the above material (following the outline below) to this google slides presentation by noon on Tuesday:
    a. Pick one proposal from the links in item 1 (or choose a different proposal but run by course instructors first) and in 2 - 3 slides a summary of the project, relevant data sources and how you would test and develop the project using data analysis.
    b. For your two project proposals, provide the following:
        i. Concise project proposal
        ii. Summary of related work or research. What have others done with the data you are using? Has anyone else tried to address a similar problem?
        iii. Proposed datasets (either open or needed to be generated)
            1. How will you use this dataset?
            2. What are the attributes you will use?
            3. What attributes do you need to create?
        iv. An initial outline of how you will develop your project. What techniques will you use? (Specifically identify any tutorials/techniques from this course you will use.) How will you present your results? What are the challenges?

Week 4, February 12th

Guest Lecture by Meli Harvey, former Computational Designer at WeWork Cities**:** A Brief History of Data Visualization
Workshop to vet, pick and develop project proposals

Assignment:

Start developing your project. Based on the roles that you have established on your team, outline your project and distribute tasks. For next week, focus on initial data exploration and a clear presentation of your proposal. Remember to treat this project as a proof-of-concept for evaluating viability for further development (rather than trying to produce a final product or a single, vetted solution.) Think of this as a pitch to the city (or other relevant stakeholders) to convince them of the merits of your project. Don't get hung up on solving issues that don't matter in evaluating viability.. Specifically address:

- By 5pm on Tuesday send Me 1) 1-3 sentence concise project statement and 2) Your specific first three steps for developing your project (ie, merge these three datasets, map X looking for Y spatial distribution, plot X and Y to look for correlations, build new dataset by doing X, Y and Z etc.)
- Are you missing data needed for your project?
- For next class, create an initial data driven-narrative exploring relevant data and detailing initial insights. Avoid lots of text. Use charts, maps and diagramming.
- Be prepared to discuss: What are your assumptions? What are your testing? What are the questions you can't answer in the space of a semester? How are you evaluating success or failure? What are different scenarios to consider? As discussed in class, not all projects will be able to address this yet. Some projects will start by merging datasets or creating a new dataset and what you are testing and various scenarios
- Outline your workflow. How are you going to develop your project from now to the midterm? Make this graphic and not text heavy.
- Post your material here. You you will have 10 minutes to present. Practice and be concise!

Week 5, February 19th

Spatial Analysis Workshop (Shadows and Views)

Lecture: Zoning for Shade and Shadow (and spatial analysis)
Workshop Materials. You'll need to install the Horster grasshopper plugin in.
In class assignment outline at the end of the lecture above. Post your three slides here by noon on Friday. (Spend no more than an hour.)

Reading:

- Weapons of Math Destruction: Cathy O'Neill. Read the Introduction and Chapter 1, pages 9-25. The rest of the book is highly recommended.

Assignment:

Time to step away from your group mates and your data spelunking to contemplate visualization and assumptive models alone. Evaluate a personal behavioural model that governs decisions you make daily and consider what it would take to represent a story about it.

First, find a data visualization or set of visualizations that you find graphically, compelling and informative. Look for a visualization where you gain insights that would not be possible if just presented from the raw output of the model or analysis. Alternatively it could be a data visualization that you take issue with, one that you want to discuss in the context of this class. Think about the simplicity or complexity of the visualization. What is actually necessary in the visualization for the intended narrative. For example, if you removed all color, would it still be legible. As a start, review the representation links below, but you are certainly not limited to those examples.

Next, sketch out a representation following the graphic framework your chosen visualization precedent of a personal model you follow according to Cathy Oneill's description of models (reading below.) It can be important or not important, like how you would model how you like to eat. Make a series of dummy representations based off your precedent that would demonstrate the manifestation of that model in data, a scatter plot plotting the expense of your meals as a function of your income per month? Buildings you see based on day of the week it is? Hours of sleep correlated to number of units per semester? Or hours of sleep correlated to your review schedule? The model examples that Cathy O'neil provides are not spatial. The models for our class are. While you personal models for this assignment don't need to be spatial, think about how this way of structuring a model would engage with spatial representation.

Do these quickly on trace or as screenshots. We will break into two groups and will share these models, discuss their assumptions and the graphic representation structure. Does it confirm assumptions or debunk them? What have you learned about one another? Were there common

inflection points in the function of your lives? Our lives have different scales and units. So these charts don't need it.

Post your images of your sketches to this google slides presentation, print and bring them with you to class, we will pin them up as part of a data bootcamp.

Representation Precedents

- The Feltron Report
- Edward Tufte: The Visual Display of Quantitative Information, Part 1
- http://datavizproject.com/
- http://rawgraphs.io/gallery/
- Fortune Magazine Visual Archives - A whole range of old infographics and data mappings. Clunky website, but great stuff if you take the time to dig around.
- http://www.radicalcartography.net
- https://pudding.cool/
- https://lust.nl/
- http://blueshirt.com/
- https://bl.ocks.org/mbostock
- https://github.com/d3/d3/wiki/Gallery

Week 6, February 26th

Lecture: Data Viz Toolbox

Workshop: Review Modeling Assignment

Assignment: Continue on your group work in preparation for presenting your progress to Frank Ruchala on March 5th. Post your projects here. Treat this as a pitch for your project and a dry run for the Midterm next week. Now that you have done data exploration, plotting and mapping, make a quantitative pitch for your project. You will have 10 minutes to present your project and get feedback from Frank.

Week 7, March 5th

Guest Lecture: Frank Ruchala, Director of Zoning, NYC DCP

Assignment / Midterm Deliverables
Prepare a concise narrative using the data exploration and analysis you have been doing to pitch your project. Make a data-driven argument for your project, and pitch for how you will do a proof-of-concept for it in the second half of the class. Unlike previous progress presentations this should not include workflow and techniques. Treat this as the first half of your presentation for the final.

Read this NYT article about the shadows in NYC to see how they drilled down into the dataset to craft a story. Note the use of specific examples (and when,) how insights were illustrate (graphically vs through text,) and how they structured the narrative.

Consider using Kepler to visualize your data. The tutorial here shows how easy it is to upload, visualize and filter data with Kepler.

End with a (brief) outline of how you will develop your project in the second half of the semester.

Presentations should be no longer than 10 min. We will keep time and let you know when you have 2 minutes left. Post your presentation here.

Week 8, March 12th: Midterm

Each team will have 10 minutes to present their midterm presentations which should be in the following Google slides document.

Assignment:

- Read: Five Boroughs for the 21st Century, Digital Matatus
- Revise your presentation based on feedback from the midterm. Treat this as the first half of your final presentation for the course. Streamline your analysis and narrative. Be concise and produce a presentation that is 5 minutes max. Because of the short length in presentation we will try to have all teams present and get feedback from the guest lecturer, Sarah Williams. Rehearse your presentation to get it to 5 minutes.
- Now that we've gotten comfortable with basic map and chart types, it's time to explore more complex data visualizations. Add one slide at the end of your presentation that attempts to synthesize the data exploration you did in the first half of the semester. Use basic charts in unconventional ways, combine different chart types, and represent different data types in the same visualization. Be experimental. Take a look at Fortune Magazine Visual Archives and the The Feltron Report for examples of dense but clear graphics.
- Place presentations here.

Data Driven Proposals: Design, Planning & Policy

In the second half of the course, the initial data merging and analysis will be used for speculative scenario testing. Projects can range for planning to design to policy, but all must propose and test changes within the framework of the initial analysis. This will include identifying sites for application, testing the impact of new development, and establishing performance based rules for new development. Students will develop real proposals for how the city might approach new development in the future from cost and value creation, to infrastructure, to zoning and land use policy, to massing and urban form.

Week 9, March 26th

Guest Speaker: Niantic
Project Reviews

Assignment:

- Present updates to your project per in person and e-mail feedback. We will present in the following order.

Week 10, April 2nd

Guest Speaker: Dr. Carlos Cerezo, Director of Environmental Design, KPF
Lecture: Data Viz Toolbox, Google Places Study

Assignment:

- Finish creating your new spatial data set. It is critical to finish creating it this week.
- Diagram your urban speculation / intervention and the scenarios for testing them. This could take several forms, a sequential workflow diagram, a series of individual sketches, or something else. The diagram(s) need to include the following:
    a. How are you measuring the success or failure of your project? Is it spatial: shadow casting, proximity to transit, or is it just numeric: new housing units, increases in property tax revenue?
    b. What are the scenarios you are going to test?
    c. Review how scenarios were established and defining in Reprogramming Mobility: The Digital Transformation of Transportation in the United States.
- We will present in the following order.

Week 11, April 9th

Guest Speaker: TBD

Assignment:

- Implement your urban speculation / intervention. This should be both focused on qualitatively evaluating the success of failure of the scenarios and creating a compelling vision for your project.
- Have a draft of your final image that attempts to synthesize the data exploration you did in the first half of the semester. Use basic charts in unconventional ways, combine different chart types, and represent different data types in the same visualization. Be experimental. This is the image that will be in Abstract, it is the image that you will use to explain your project to potential employers. It should be ambitious and beautiful.
- Prepare a complete draft of your final presentation. Include places holders for the type of outcomes you are expecting and your evaluation criteria. At this point we've discussed the full arc of each project. Take the time to turn that into the framework for your final presentation.

Week 12, April 16th

How to Design Smart(er) Cities or Guest Speaker: TBD

- We will present in the following order.

Assignment:

- This is the week you finish your data analysis, exploration and testing and switch to visualization and crafting your narrative. Treat you project as a proof-of-concept that demonstrates the potential as a pitch for the city to take on as a real project.

Week 13, April 23rd

Guest Speaker: TBD

- We will present in the following order.

Assignment:

- Finish your project!

Week 14, April 30th: Final

Place Final Presentations Here. You final presentation should be 10 min max.
Deliverables:

- Final presentation
- Final image
- 3 high resolution images (including your Final Image) for submission to abstract

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