

# Portfolio

Spatial Data Analytics / Urban Planning

<https://annannzhang.github.io/>

Ann Zian Zhang

# Ann Zi'an Zhang



Python, R, ArcGIS Pro + Online, Excel  
Adobe InDesign, AI, PS  
JavaScript, html

## SKILLS

Master of Urban Spatial Analytics &  
Master of City Planning  
University of Pennsylvania  
2022-2024

B.A. in Art History, Psychology, and  
Science in Society, with High Honors  
Wesleyan University, CT  
2018-2022

## EDUCATION

Intern, Planning + Urban Design, WRT  
Philadelphia, PA  
Jan 2024 - Present

Intern, Economics, AECOM, Shanghai  
Dec 2023 - Jan 2024

GIS Intern, Urbanism + Planning,  
AECOM, Hong Kong SAR  
Jun 2023 - Aug 2023

## EXPERIENCE

# Table of Contents

## INDIVIDUAL

- 04 All About Arts (Python)
- 06 In-class Projects Compiled (Python)
- 09 Union Sq. Biz Dashboard (html dashboard)
- 10 Tipsy Tonight (html Storymap)

## TEAMWORK

- 12 Housing / Airbnb Price Prediction (ML / Regression)
- 

SPATIAL

DATA

ANALYTICS

## TEAMWORK

- 14 Bogota: Transit Equity & Housing Affordability
  - 16 Plan for Garrett Road, Upper Darby, PA
- 

PLANNING

Please refer to separate writing samples.

# All About Arts

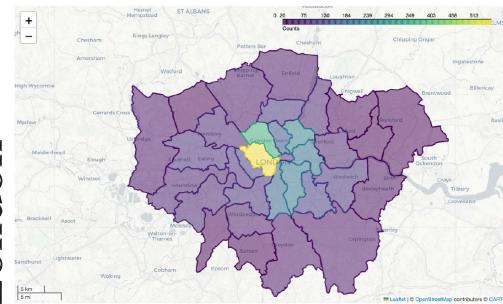
Python | (Quarto) <https://annannzhang.github.io/Python-Projects/>

This project is the final project for Geospatial Python class. The project consists of three parts that explore the arts and cultural infrastructure in New York City and London, utilizing different types of analysis in python.

## Part I - Arts & Culture in New York & London

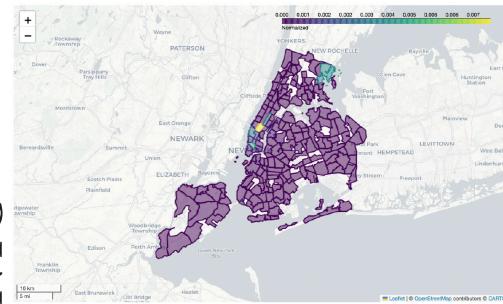
**Key Findings:** Both in NYC and London, we are seeing a disproportionately higher density and more variety of art and cultural infrastructure in city centers. However, interestingly, there isn't a clear positive linear relationship between household income and number of art and cultural amenities – it seems like lower income communities also have access to a decent number of infrastructures, through incomparable to the diversity present in city centers. The most famous and largest museums, including but not limited to the Metropolitan Museum of Art, Modern Museum of Art, and the British Museum, are all located in more of the central area.

Spatial Distribution of Cultural Amenities

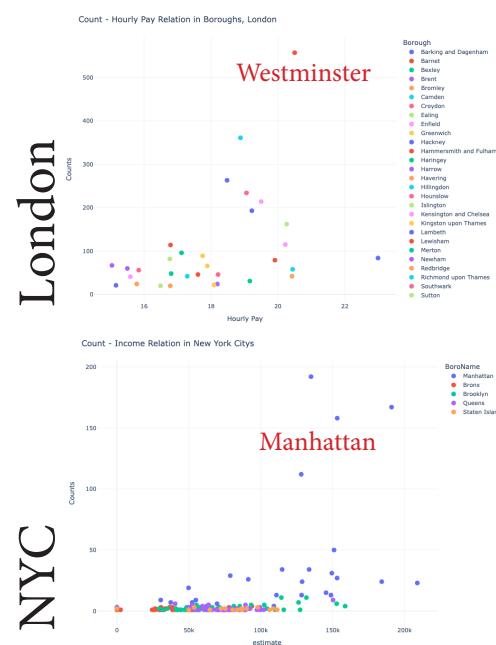


London

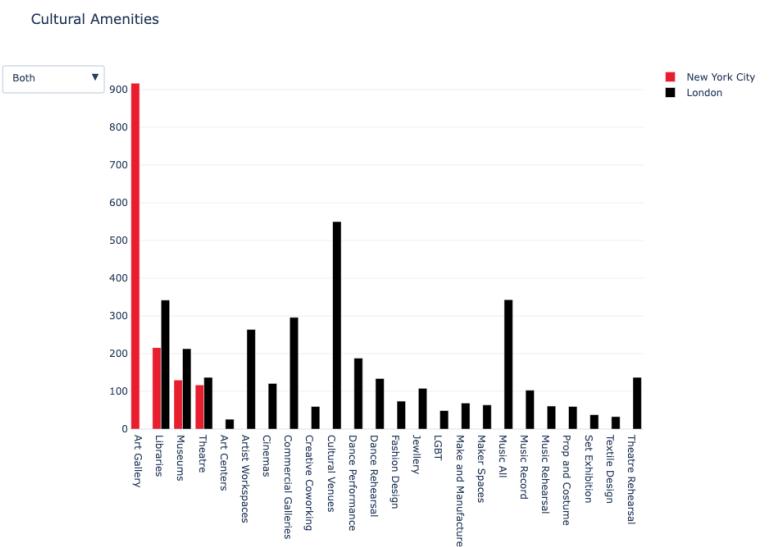
NYC



Number of Amenities x Income



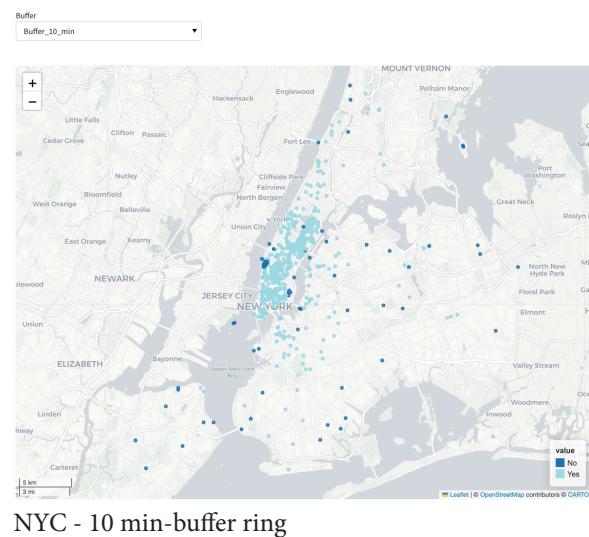
Comparison: Number of each type of arts and cultural amenities



## Part II - Public Transit Access and Street Network Analysis

## Public Transit Access: Distance to Metro/Tube

The NYC dashboard shows the amenities that are located within 2-minute, 5 minutes, and 10-minute walkshed buffering, and the London one on the other hand shows 5-minute, 10 minutes, and 15-minute buffers. This decision is made partially due to the fact that the Greater London area is a lot larger than NYC. We can see that most NYC amenities falls within the 10-minute walking buffer and most London ones fall within 15-minute buffer, showing their great accessibility.



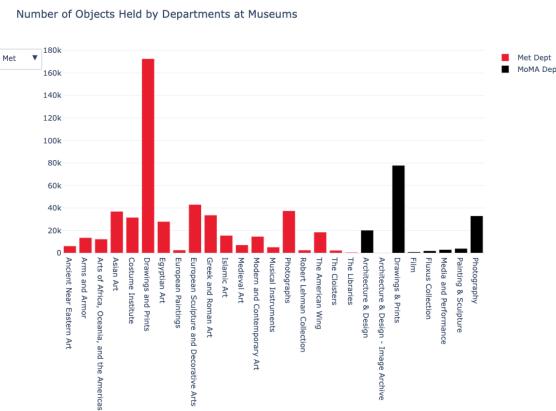
## Street Network Analysis in NYC: Driving time to JFK Airport

Another potential way to judge their accessibility to outside travelers is through OSM network analysis. Here, I'm using JFK airport and the cultural centers in Manhattan as an example. JFK airport serves as a transit hub and hence is the node of origin in this analysis. Sample result is shown in the table below.

| Name                                   | Address                          | geometry                   | shortest_travel_time (in Minutes) |           |
|--|----------------------------------|----------------------------|-----------------------------------|-----------|
| 0 Alexander Hamilton U.S. Custom House | 1 Bowling Grn                    | POINT (-74.01376 40.70382) | 739.8                             | 12.330000 |
| 2 American Academy of Arts and Letters | 633 W. 155th St.                 | POINT (-73.94730 40.83385) | 982.3                             | 16.371667 |
| 3 American Folk Art Museum             | 45 West 53rd Street              | POINT (-73.97810 40.76162) | 1043.4                            | 17.390000 |
| 5 American Museum of Natural History   | Central Park West at 79th Street | POINT (-73.97365 40.78083) | 1040.7                            | 17.345000 |
| 6 American Numismatic Society          | 75 Varick St                     | POINT (-74.00701 40.72353) | 703.7                             | 11.728333 |

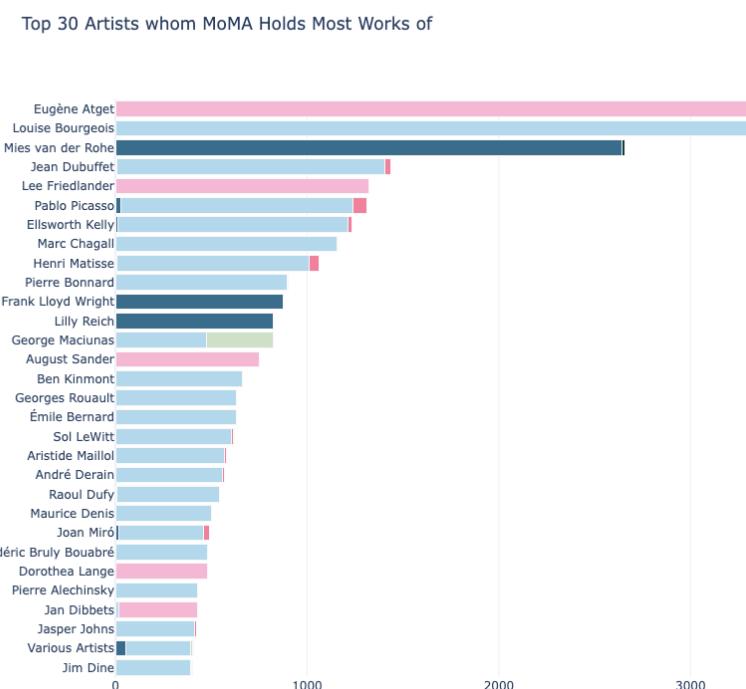
### Part III - Museum Collections: the MET, MoMA, and the British Museum

This part of the project zooms into each museum's collections. By utilizing the museums' digital collection such as public dataset by the MET and MoMA on their dedicated github page, or by web scrapping from museum's digital collection result page, I made some interesting analysis of largest collections, top artists, top nationalities, and the most frequent themes of their traditional Chinese artwork collections. This part of the projects aims to explore some possible interesting directions of digital humanities and digitization of museum archives, which has been the trend in this field for the past two decades.



### **FUN FACT:**

Top 10 Nationalities of Artists at the MET:  
American, French, British, Italian, German,  
Netherlandish, Japanese, Dutch, Scottish, Spanish.



# In-Class Projects

Python | (Quarto) <https://annannzhang.github.io/Python-Projects/>

## 1 - Street Network Analysis - Crash Data

This project utilizes osmnx (Open Street Maps' network analysis) to explore spatial patterns of car crash incidence happened in Center City in Philadelphia, PA. The network graph created from OSMnx (Fig. 1) is converted into GeoDataFrame firsts, then used for projecting the crash index geographically onto the an interactive folium map. As the results show in Fig. 2, highways like I-676 Vine Street Expressway has very high crash index in comparison to the rest of the city. This visualization is helpful for advocating for less highways for better travel safety in transportation planning.

Fig 1 - Street Network Graph from OSMnx

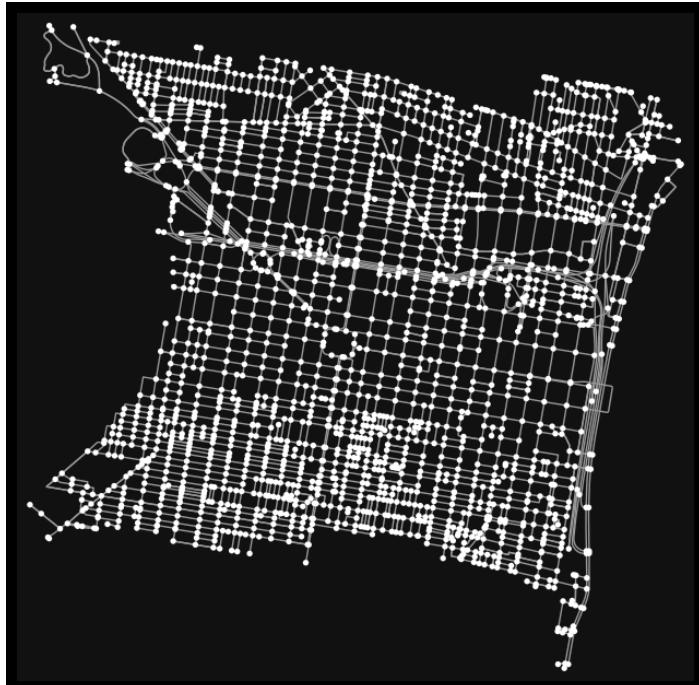
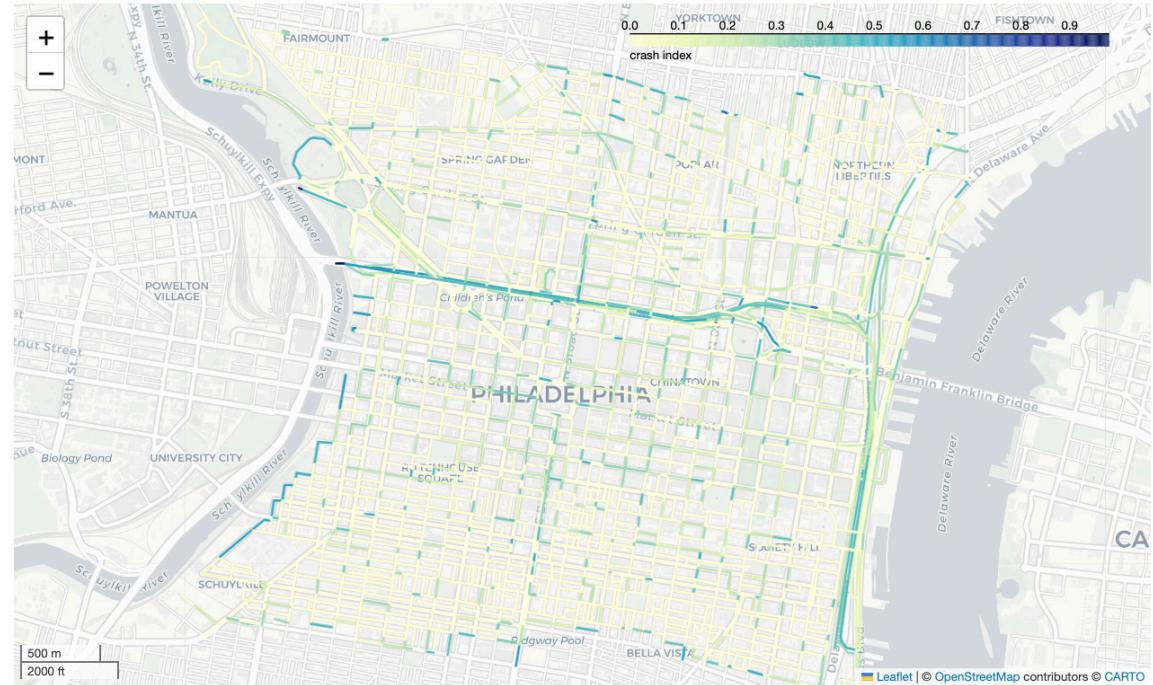


Fig 2 - Crash Index on Street Network



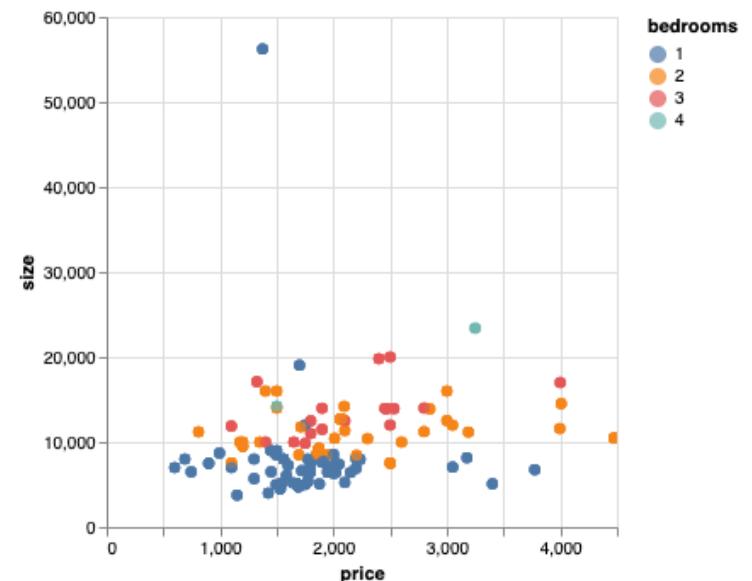
## 2 - Webscraping

In this short scrapping project, I used BeautifulSoup to scrap 5 pages of results of Craigslist's Philadelphia region apartments. The raw results are cleaned and organized into the table below. The data was then used to make analysis of the apartment market stocks at the time, of which Fig 4 is one of the findings.

Fig 3 - Scrapped Results Organized in Table

|     | price | size  | bedrooms | title   | pricepersq |
|-----|-------|-------|----------|---|------------|
| 0   | 2474  | 13942 | 3        | 3bd 2ba, Serene Wooded View, West Chester PA      | 0.177449   |
| 1   | 2850  | 13902 | 2        | Apartment by the arts!                            | 0.205006   |
| 2   | 1800  | 7592  | 1        | A Cozy Living Space In Rittenhouse Square.        | 0.237092   |
| 3   | 1750  | 5002  | 1        | Pets welcome in this Beautifully renovated apa... | 0.349860   |
| 4   | 1950  | 8502  | 2        | Enjoy a fantastic living space with tons of na... | 0.229358   |
| ... | ...   | ...   | ...      | ...   | ...        |
| 595 | 2075  | 12712 | 2        | Resort-Style Swimming Pool, Extra Storage, 2/BD   | 0.163232   |
| 596 | 1876  | 5072  | 1        | On-demand car wash/detailing, Handyman and mai... | 0.369874   |
| 597 | 1680  | 5092  | 1        | Penthouse Hideaway, LVT Flooring, Bike Storage    | 0.329929   |
| 598 | 2199  | 6922  | 1        | Fire Pit, On-site Management/Maintenance, Flex... | 0.317683   |
| 599 | 1544  | 5182  | 1        | 1 BD, Bike Storage, Washer/Dryer                  | 0.297954   |

Fig 4 - Apartment Size-Price-Bedroom Relation



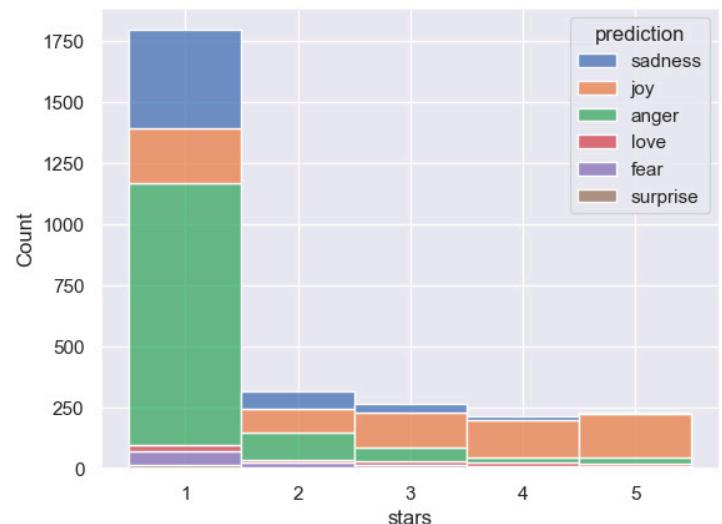
## 3 - Philly Yelp Reviews Sentiment Analysis

In this short scrapping project, I used BeautifulSoup to scrap 5 pages of results of Craigslist's Philadelphia region apartments. The raw results are cleaned and organized into the table below. The data was then used to make analysis of the apartment market stocks at the time, of which Fig 4 is one of the findings.

Fig 5 - Sentiment Analysis

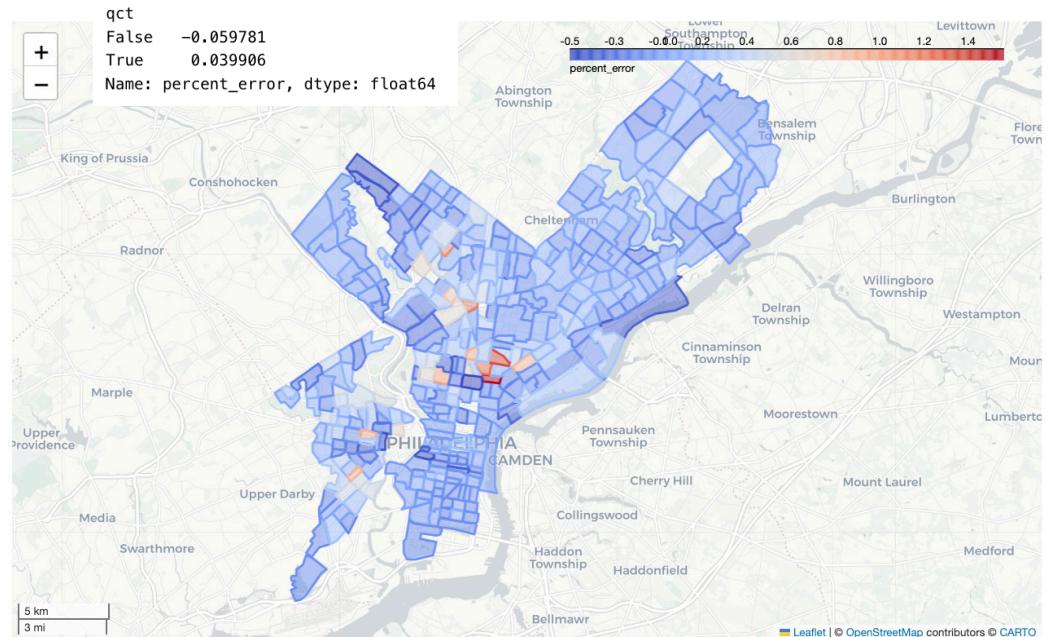
|   | sadness  | fear     | anger    | joy      | surprise | love     | text   |
|---|----------|----------|----------|----------|----------|----------|--|
| 0 | 0.733869 | 0.250676 | 0.011039 | 0.002758 | 0.001015 | 0.000643 | I know I shouldn't expect much but everything I asked for that was on the drive thru menu was not available. I was actually afraid of what I was going to get once I did get it. I saw the movie "Waiting". Word of advice stay clear of this arch. Just so you know I was only trying to order a beverage how pathetic is that. |
| 1 | 0.000230 | 0.000126 | 0.000165 | 0.998759 | 0.000246 | 0.000475 | I am only giving 5 stars because the Shamrock Shake is back and delicious!! Too bad it's around only once a year ;(  |

Fig 6 - Apartment Size-Price-Bedroom Relation



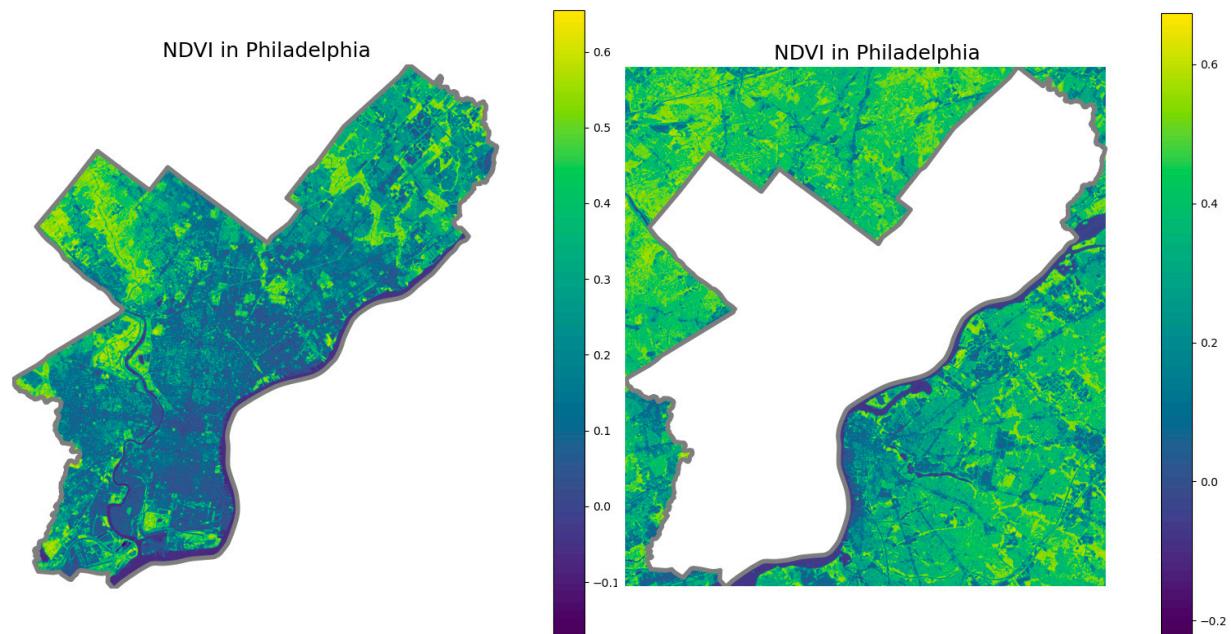
## 4 - Predictive Modeling of Housing Price in Philadelphia

This project used random forest to train on housing sales data in Philadelphia. The ultimate purpose is to 1) try to train the most accurate predicting model with the given dataset, and 2) explore if there's any predictive biases in different neighborhoods, particularly putting some groups in disadvantage. The percentage error of the trained prediction model is mapped on the right side. We can see several neighborhoods are experiencing more errors. And if we compare error of Qualifying Census Tracts (poverty designation), we will find the QCT experiencing over-valueing, which may cause housing affordability issue.



## 5 - Rasterio: NDVI in Philadelphia

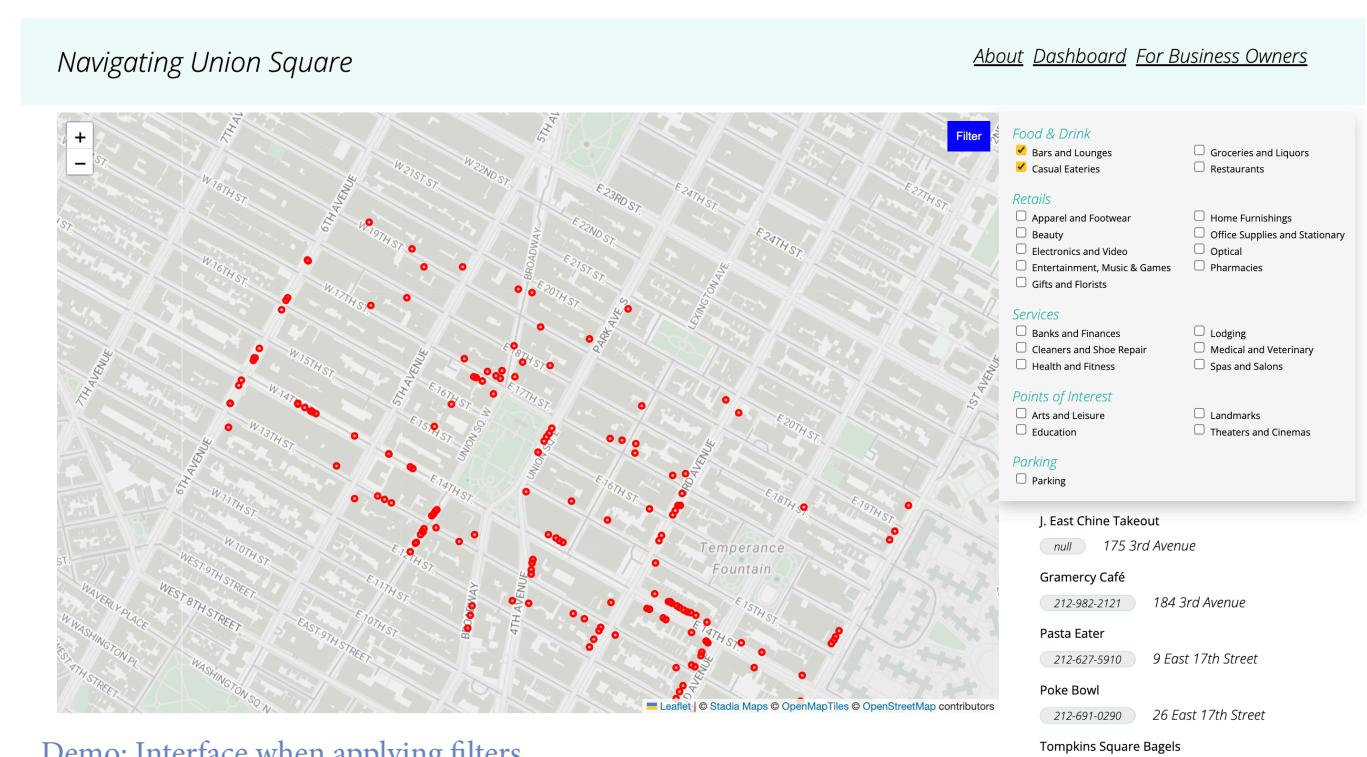
This project aims to explore the green coverage within the boundary of city of Philadelphia versus the immediate outside. Rasterio and matplotlib are used for calculating and visualizing the NDVI, or Normalized Difference Vegetation Index. NDVI is calculated as the ratio between the red and near infrared values. The maps on the right shows that the NDVI in the city tends to be lower than outside of the city. This may be due to the excessive impervious surfaces in the city. Zooming into the map, we can also identify that some neighborhoods in south philly, in particular has lower NDVI comparing to the rest of the city.



# Union Sq Biz Dashboard

## Dashboard | JavaScript, html, css

This dashboard is created as a part of a JavaScript class for planners and spatial analysts. It displays operating businesses at Union Square in Manhattan, New York City. For long, Union Sq. has an importance in NYC, both in terms of its central geography and vibrant commercial activities. The dashboard opens to both visitors and business owners, with the objective of bridging the two groups for prosperities. The visitors can apply filters to check their desired type of business, or search through the address / businesss entry search bar. Business owners will get a chance to upload introductory or promotional messages, which will show up to visitors when they click on specific business.



Demo; Interface when applying filters.

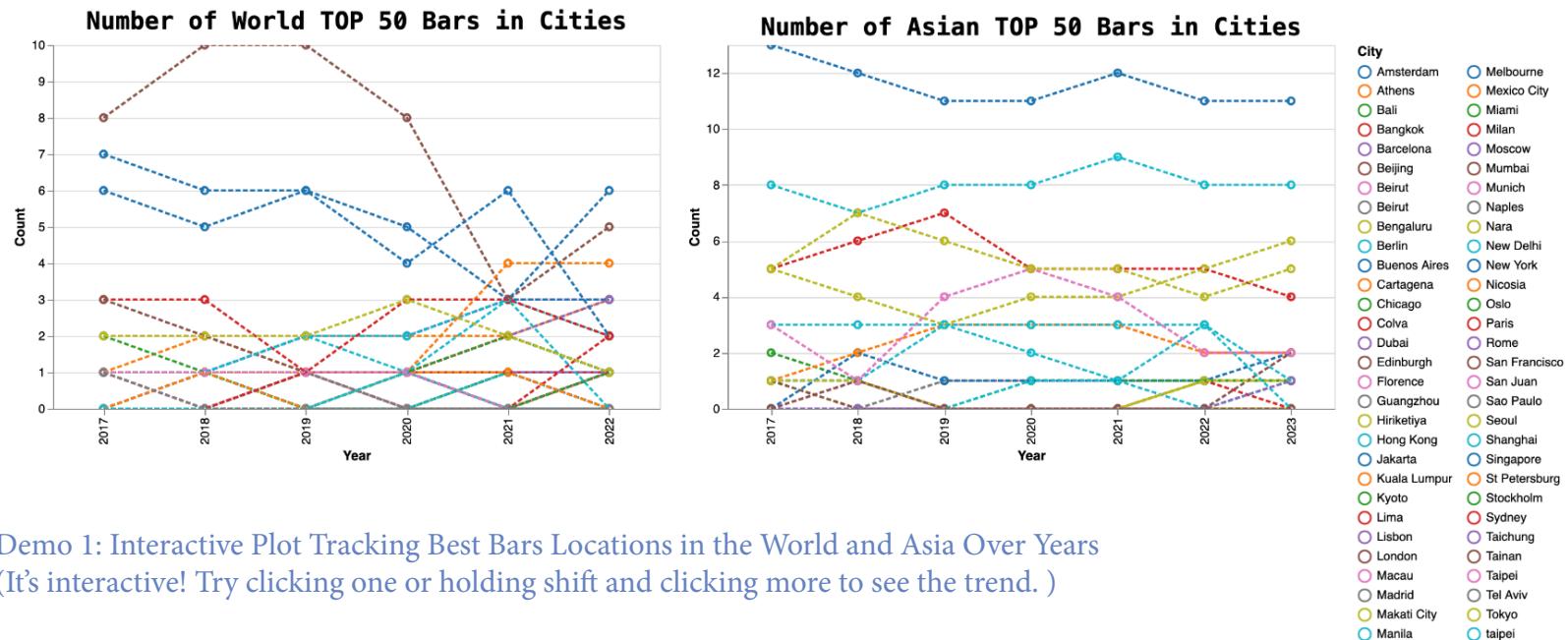
The main motivation behiind this dashboard / navigation app is to prototype a potential channel for promotion and outreach of Business Improvement Districts across the country and the world. BID's would have the incentives and resources to promote the local business. And once the template is setup, they only need to have regular maintanence and update the operating businesses.

**Looking into the future:** As mentioned above, the operational cost may be a burden for BID, especially when they are just starting. Yet in long term, I believe it is meaningful and helpful for local businesses who doesn't have enough resources for online marketing to have a platform to communicate directly to the visitors and potential customers for free.

# T(ipsy) \_ T(onight)

# Story Map | JavaScript, html, css

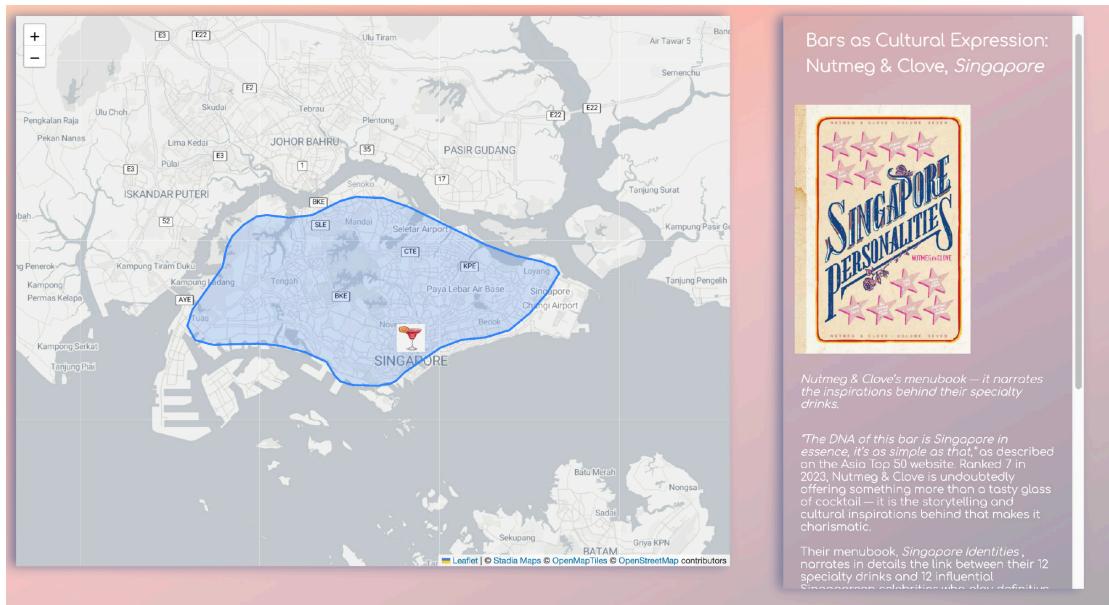
This storymap is born out of my personal interest and passion for drinking and my curiosity in how the bars are judged / marketed around the world. Coming from Asia, I am witnessing the raise of bars in Asia, not only in terms of quantity but also quality. Award-winning local bartenders and owners start to integrate the essence of local culture into the drinks, the interior design, and the whole bar experience. On a city level, many metropolitan cities are home to highly-ranked beloved bars, which turns to be their soft power and attraction to younger generations.



Echoing the City's soft power point, I tracked how many Top 50 bars each city is home to from 2017 to 2022 (2023). As you will find when interacting with the graph, cities like London has been home to many top-rated bars over years. Regionally in Asia, Singapore and Hong Kong are undoubtedly the champions in hosting unique and high-quality-bars. During my research, on the other hand, I found Chinese cities like Beijing and Shanghai have been seeing a downfall over the COVID years, potentially due to the lockdowns. It will be interesting to see whether they will rebound from now.



## Demo 2: Storymap Slide Deck Interface



## Demo 3: Bar Highlight

The storymap's slidedecks aim to capture both the general trends around the world (e.g., World's TOP 50 bars are largely located in North America and Europe, showing potential biases of the criteria and ranking systems) and callouts on specific cities or bars that are unique in some ways (e.g., Hong Kong's Lan Kwai Fong and bar industry is very representative.)

# Housing/AirBnB Price Prediction

## Regression & Machine Learning | R-Studio

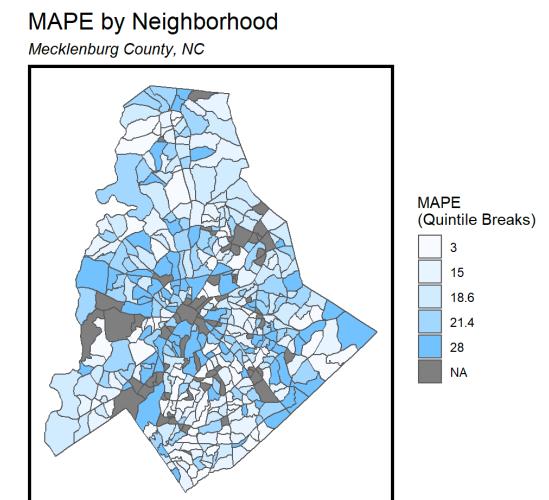
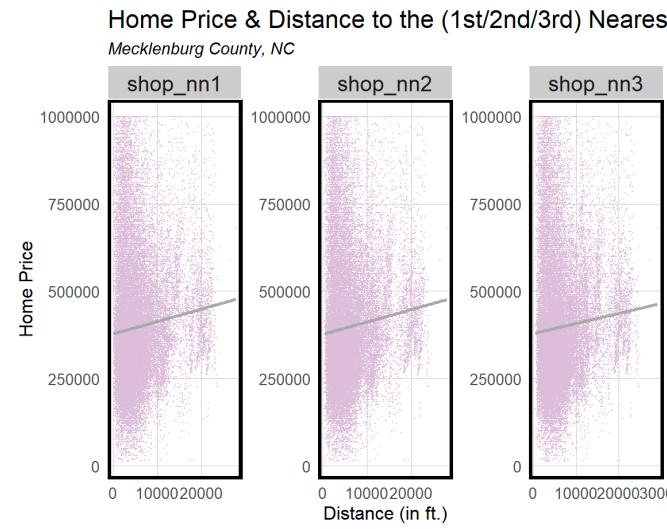
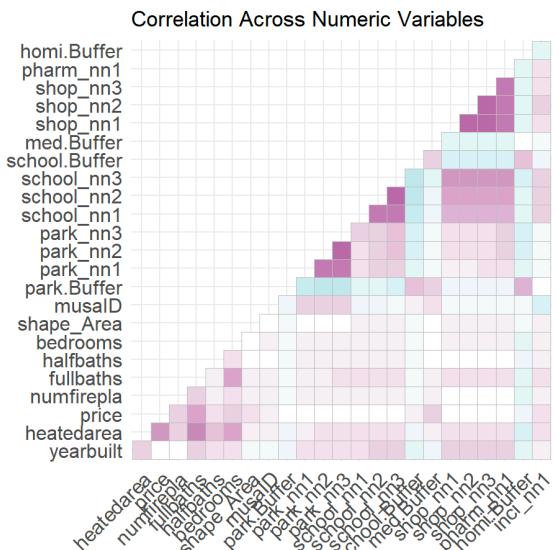
Two projects in this section both uses basic linear regression and machine learning to conduct price prediction. One is predicting Charlotte's housing price, while the other predicts the airbnb price in Amsterda. Respective geo-social factors and nature of houses for purchase vs. airbnb for short rental are considered when creating the prediction model. All analysis and visualization are done in R-studio.

## Charlotte, NC Housing Price Prediction

Project In Collaboration with Ben Keel.

To train the model, me and my teammate has been exploring critical factors that can contribute to higher predictability. We have identified factors like closest parks, shops, schools, etc. and acquired data from the city's open portal. We then looked at the correlation across all factors to clean up. Using our model, the adjusted R-squared is 0.712, which indicates a decent predictability. The mean absolute percentage error is mapped, and we can identify some clustering near the city center, though not entirely obvious.

```
##  
## Regression Results  
## =====  
##                                         Dependent variable:  
##                                         price  
## =====  
## Observations                         37,900  
## R2                                    0.713  
## Adjusted R2                           0.712  
## Residual Std. Error      213,352.000 (df = 37789)  
## F Statistic                          853.159*** (df = 110; 37789)  
## =====  
## Note:                                     *p<0.1; **p<0.05; ***p<0.01
```

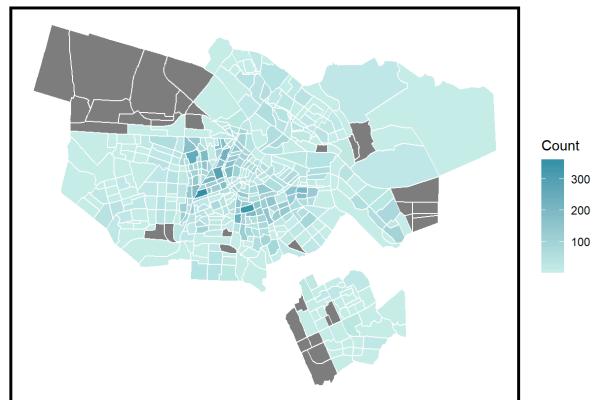


# Amsterdam Airbnb Price Prediction

Project In Collaboration with Ben Keel and Tom Sun.

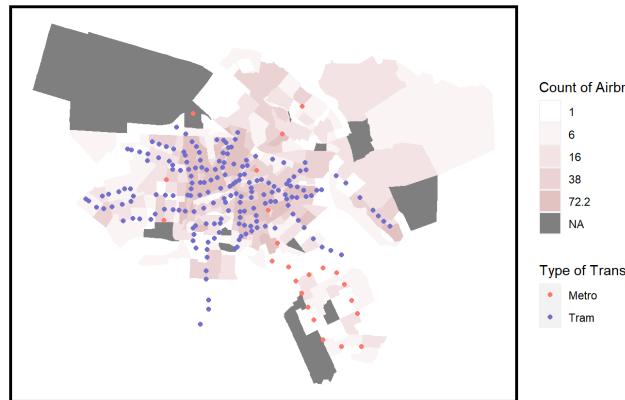
Number of Airbnb per Zipcode

Amsterdam, NL; 2018



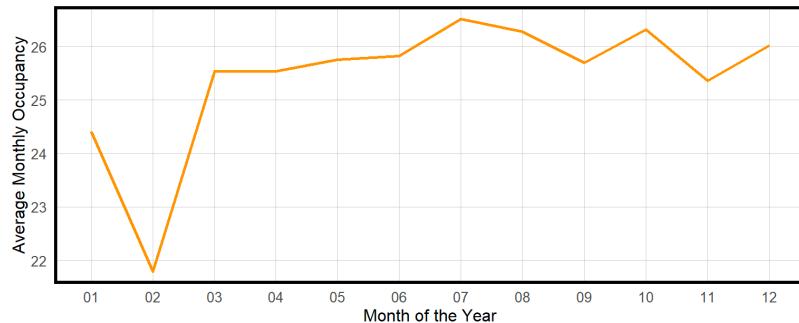
Public Transit & Number of Airbnb

Amsterdam, NL; 2018



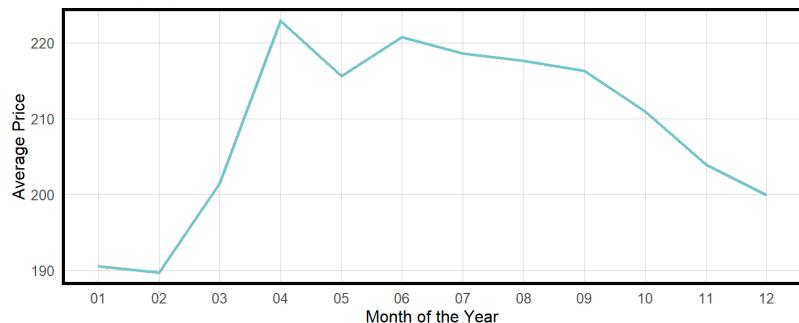
Airbnb Occupancy Every Month

Amsterdam, NL; 2018



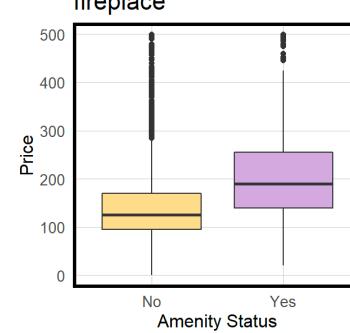
Average Airbnb Price Every Month

Amsterdam, NL; 2018

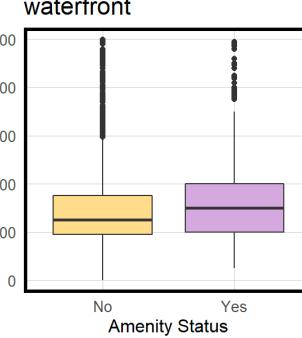


The special characteristic and major difference from the Charlotte project is the seasonality and variation of Airbnb prices. Hence, for this project, we not only incorporated factors that are important for tourists, such as public transit and amenities (e.g., pool, parking), but also take seasonality and occupancy data each month into consideration when we were creating the model.

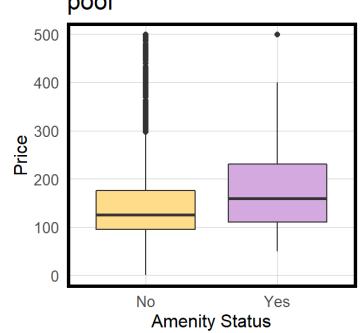
fireplace



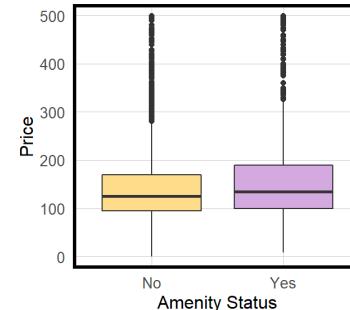
Price w/ vs. w/o Amenities



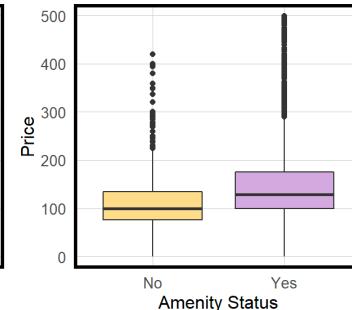
pool



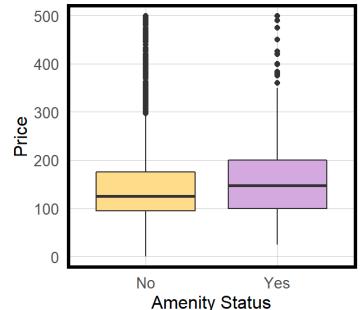
parking



kitchen



AC

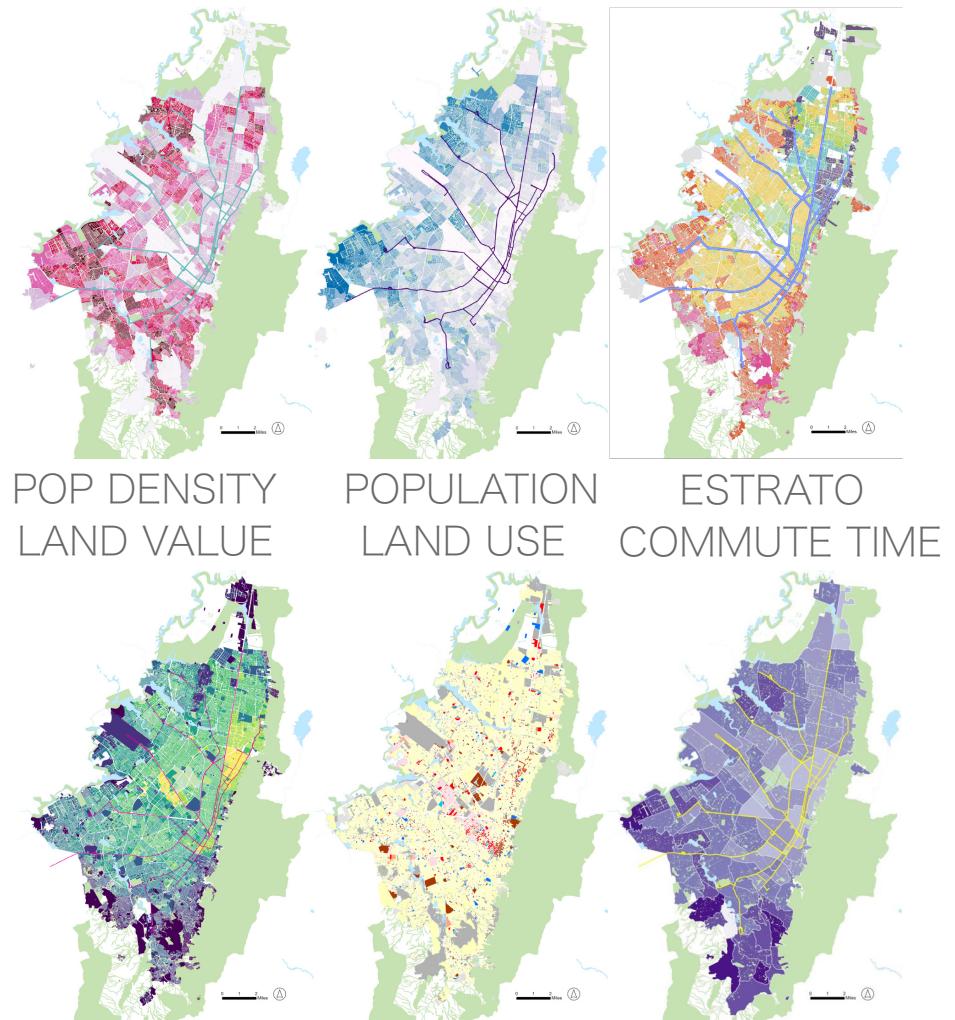


# Bogota Transit Equity & Housing Affordability

## Existing Condition Research

Project In Collaboration with Ke Zhou, Evan Zhao, and Teresa Chang;  
All work displayed on this page completed by myself.

This is a studio project done in-class. My teammates and I looked closely at the transit equity and housing affordability issue in Bogota, Colombia. We found that despite the previous success of the implementation of the famous BRT system, not all areas in the city receive equal access to such high capacity service. Those majority living on the peripheries are experiencing extremely long commutes and at risk of safety concerns, including crashes and assaults. The modal share graph below also shows a difference in gender -- female experience more internal walking trips and external TransMi (BRT) trips while male has more diverse range of choices for travel mode. The common concern on public safety, especially women, inspired my intervention project on enhancing travel safety, which is shown in the next page.



# Intervention Project Proposal: Travel Safety in Bogota

In Collaboration with Teresa Chang; All work displayed on this page completed by myself.

To enhance the safety of traveling during both internal and external trips, *Viaje a Gusto* is designed to be a bipartite program involving two complementary projects. *Viaje sin Peligro* ('Travel without Danger') targets internal walking trips through sidewalk enhancement and streetlight redesign. *Viaje sin Miedo* ('Travel without Fear') aims to tackle safety on public transportation (mainly SITP), particularly the prevalent issue of sexual harassment. Each project engages three key strategies.

## Internal Trips

### **Viaje sin Peligro**

(Travel w/o Danger)

**Sidewalk and Streetlight**

Enhancement and Redesign

## External Trips

### **Viaje sin Miedo**

(Travel w/o Fear)

**Safety on Transit, Less Sexual Harassment Initiative**

**1 General Sidewalk Enhancement**

**2 Streetlight Enhancement**

**3 Permeability - 'Natural Surveillance'**

**1 Priority Seating and Waiting Area**

**2 Social Campaign**

**3 Text Reporting System**

This is our proposal for increasing permeability and transparency right nearby a major TOD transit hub. By opening up facades, we are encouraging 'natural surveillance' and making pedestrian feel safer when walking.



# Viaje a Gusto

## NO AL ACOSO

Para las Mujeres  
Para los Hombres  
Para todos



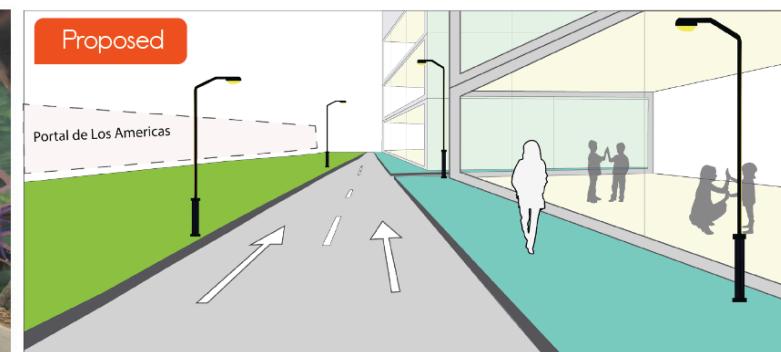
Reportar acoso  
a la policía /  
TransMilenio Conductor(a).  
Viajes a gusto  
para todos.

NO AL  
ACOSO,  
VIAJE SIN  
MIEDO

Reportar acoso  
a la policía / TransMilenio Conductor(a).  
Viajes a gusto para todos.



Poster Design for Social Campaign to raise awareness of sexual harassment on public transportation.



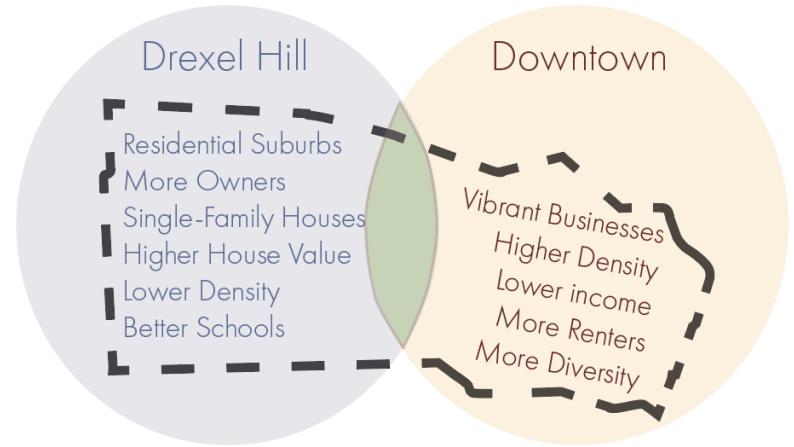
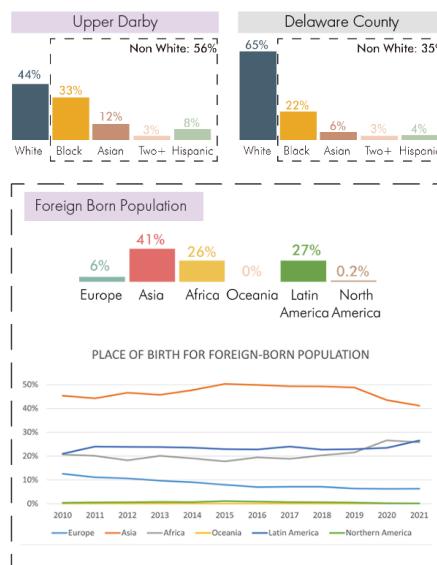
# Garrett Road Corridor, Upper Darby, PA

## “The World in One Place”

### Existing Condition Research

Project In Collaboration with Alexa Ringer, Alex Nelms, Ling Chen, Zhida Ma, Shreya Bansal, and Sidney Kuesters.

For this studio course, my team looked at Garrett Road Corridor in Upper Darby, PA, adjacent to the city of Philadelphia. In addition to the quantitative analysis using census and other public data, we have also focused on qualitative information, especially regarding the socio-cultural aspects. We have identified issues and opportunities for this corridor and Upper Darby township, which includes assets such as largely diverse cultural backgrounds and advantage as a regional transit hub, and issues such as the disparities between the Drexel Hill area versus Downtown Upper Darby.



### ISSUES & OPPORTUNITIES

#### Transit & Land Use

- Investments in Infrastructure Rich Transportation
- Inaccessible & Inadequate Public Spaces
- Vulnerable to Flooding
- Negative Perception of Transit & Downtown
- Car Dependency & Car-Centric Development

#### Architecture & Housing

- Enclave of Historic Sites
- Affordability
- Redevelopment
- Displacement

#### Community

- Diverse & Multicultural Enclave
- Concentrated Disparities
- Lack of Civic Engagement & Cohesion

# Intervention Strategies

Project In Collaboration with Alexa Ringer, Alex Nelms, Ling Chen, Zhida Ma, Shreya Bansal, and Sidney Kuesters.

Upon identifying issues and opportunities, me and my teammates have created a set of intervention strategies and categorized based on their targeted geography. Corridor-wide recommendations are mainly zoning or program-based, which requires mostly top-down effort policy wise and may require a large amount of investments. Recommendations on Downtown development focuses more on economics and cultural aspects, including setting a BID and creating social campaigns to advertise Upper Darby as a rare cultural enclave in the region. Park and Open Spaces recommendations focus on both equal access to existing green space and creation of new flooding-resilient infrastructure. And Garrett Road recommendations are transportation-oriented, including redesign of right of way, pedestrian walk enhancement for safety, TOD from transforming existing parking lots, etc. Each recommendation / strategy is given a priority and expected timeline. As the table on the right show, most strategies with high priority requires long-term effort and investment.



Proposed new ROW, include new greenlane and enhanced pedestrian walk.

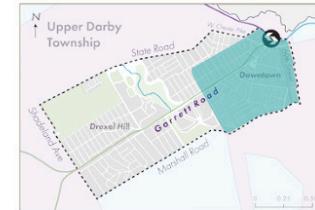
## Corridor Wide



## Parks & Open spaces



## Downtown



## Garrett Road

