Project Title: Uber Moves

Link to the project repository: https://github.com/han-ngo/Uber-Moves

Team		
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Background and Motivation.

Most people see every day traffic on their daily routine but often has any clue on the overall traffic. This project provides a visual exploration one can use to find out where and when people hire cabs mostly. This project helps uber driver to see and visualize pickups and place himself in a better place and time for maximum pickups during his work hours.

Project Objectives.

This project is about showing when and where uber pickups were made in New York city for a given month (Eg: April 2014). The primary questions that this project answers –

1. Which places have more pickups?
2. What are the peak timings in a day where most pickups were.
3. Is Uber busy on weekdays or weekends?
4. How busy is uber on the wee hours of a weekday or weekend.
5. For each pickup, tool tip provides the exact location and pickup time on mouse hover.
6. This helps a uber driver place himself in a better position to get maximum pickups.
7. This helps city traffic controllers visualize the movement of FHV(for-hire vehicles) in the city.

Data.

The data will be collected from data.world website.

The data has all the uber pickup information in New York City for a given month (Eg: April 2014). The total number of pickups for just one month is close to 600,000!

The data is in the following format:

- Date/Time : The date and time of the Uber pickup
- Lat   : The latitude of the Uber pickup
- Lon   : The longitude of the Uber pickup
- Base   : The TLC (Taxi & Limousine Commission) base company code affiliated with the Uber pickup

Link to the database:
https://data.world/data-society/uber-pickups-in-nyc

Data Processing.

The dataset includes about 600,000 items. It is very large for a serverless website. We will clean up the dataset and save those data in grids to support streaming-based data loading. Each small grid is a single json file. We will only load the data that will appear in our current viewport.

We will build another derived dataset, sampling each hour's total pickup count in a uniformly distributed grid system into one single file. When the viewport of the map is in a large scale, we will use it to display a heat-map.

To retrieve category data of specific geographic position, we will try to do some data preprocessing based on **Here Location Services**' api. It provides an api can return category information with inputting latitude and longitude.
https://developer.here.com/documentation/places/topics/quick-start-find-text-string.html

Update (10/31/2019): We will randomize and pick out 10K sample data.

Visualization Design.

Design 1:

The uber pickups will be visualized as follows –

·   All the pickup points will be placed on the New York City map as shown below -

UBER MOVES

DAVS: FRI - SUN   TIME: 9am - 10am

AM   PM

0 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11
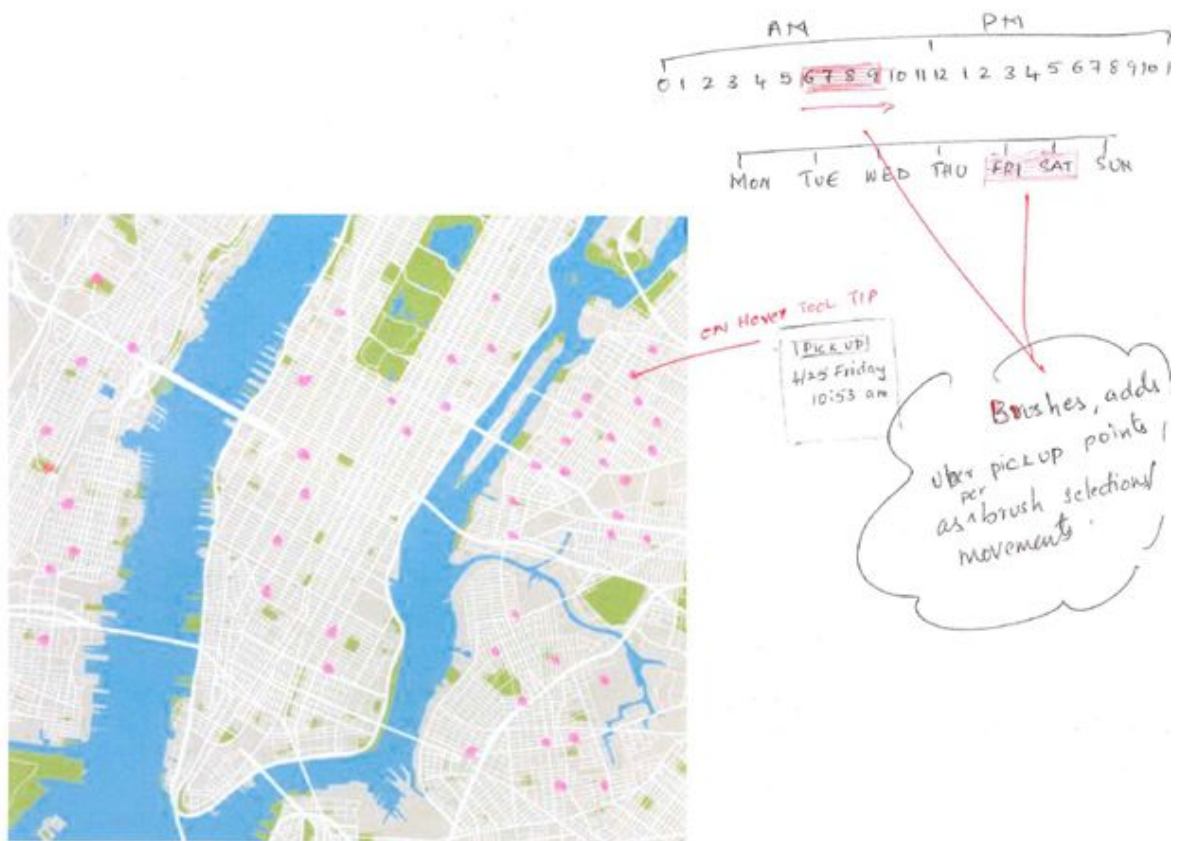
MON TUE WED THU FRI SAT SUN

Shows data for uber pickups for selected day(s)/time

· You can use brushing on either Time or Days of the week. The uber pickup points will show up or disappear on the map based on brushing area. A click anywhere on the Time or Day of the Week axis will undo brushing.

· The header on top of the map shows the selected Days and Time from brushing. By default it will be Days: *All Days* Time: *All time.*

· Any area of interest can be zoomed in by selecting a region. The zoomed map will be shown on the right side of the actual map. A click on the actual map will make the zoomed map disappear.

· A tooltip will show the details of an uber pickup point on mouse hover. Tooltip will show all the details of all points if there are multiple pickups from the same location.
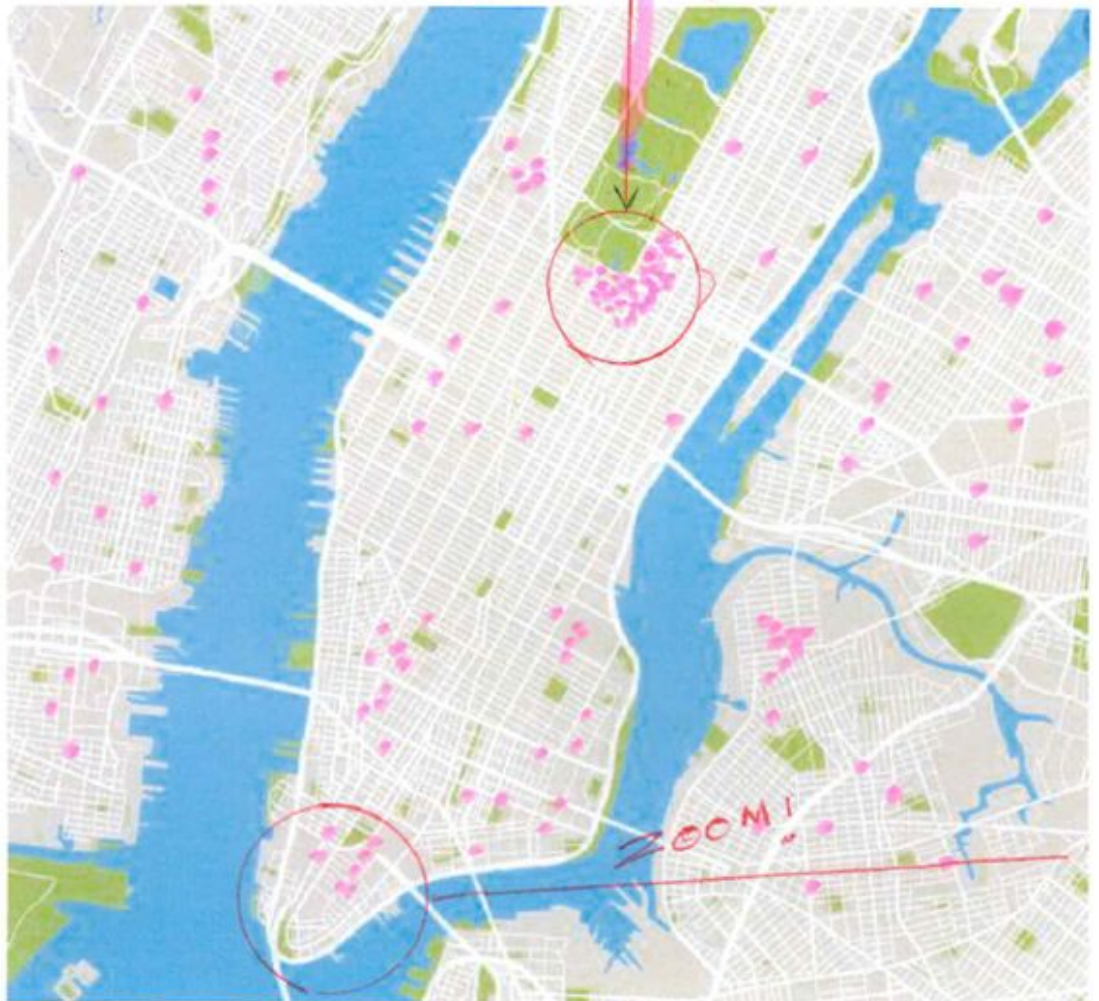
·   Pickup points will be colored lighter or darker. The color intensity increases if a spot has many uber pickups.

·   Story telling - highlighting something interesting in the visualization!
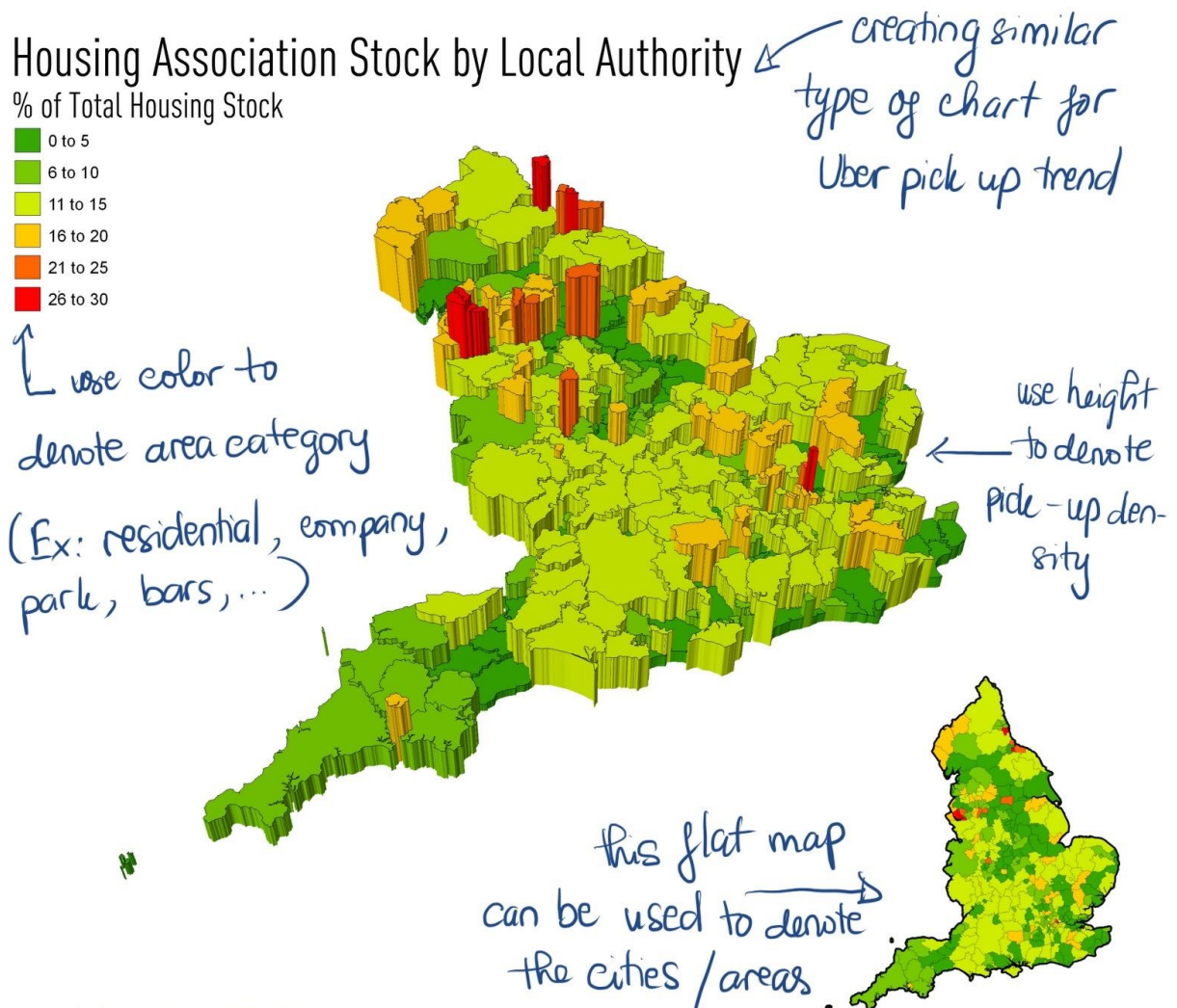
Design 2:

- Another option is using a 3d map visualization as attached below:
    - The height: representing the pick-up density
    - The color: representing area category (Example: schools, residential, work, etc.)
    - The flat map: representing the cities

Housing Association Stock by Local Authority ← creating similar type of chart for Uber pick up trend

% of Total Housing Stock

0 to 5
6 to 10
11 to 15
16 to 20
21 to 25
26 to 30

⌐ use color to denote area category

(Ex: residential, company, park, bars, …)

use height → to denote pick-up density

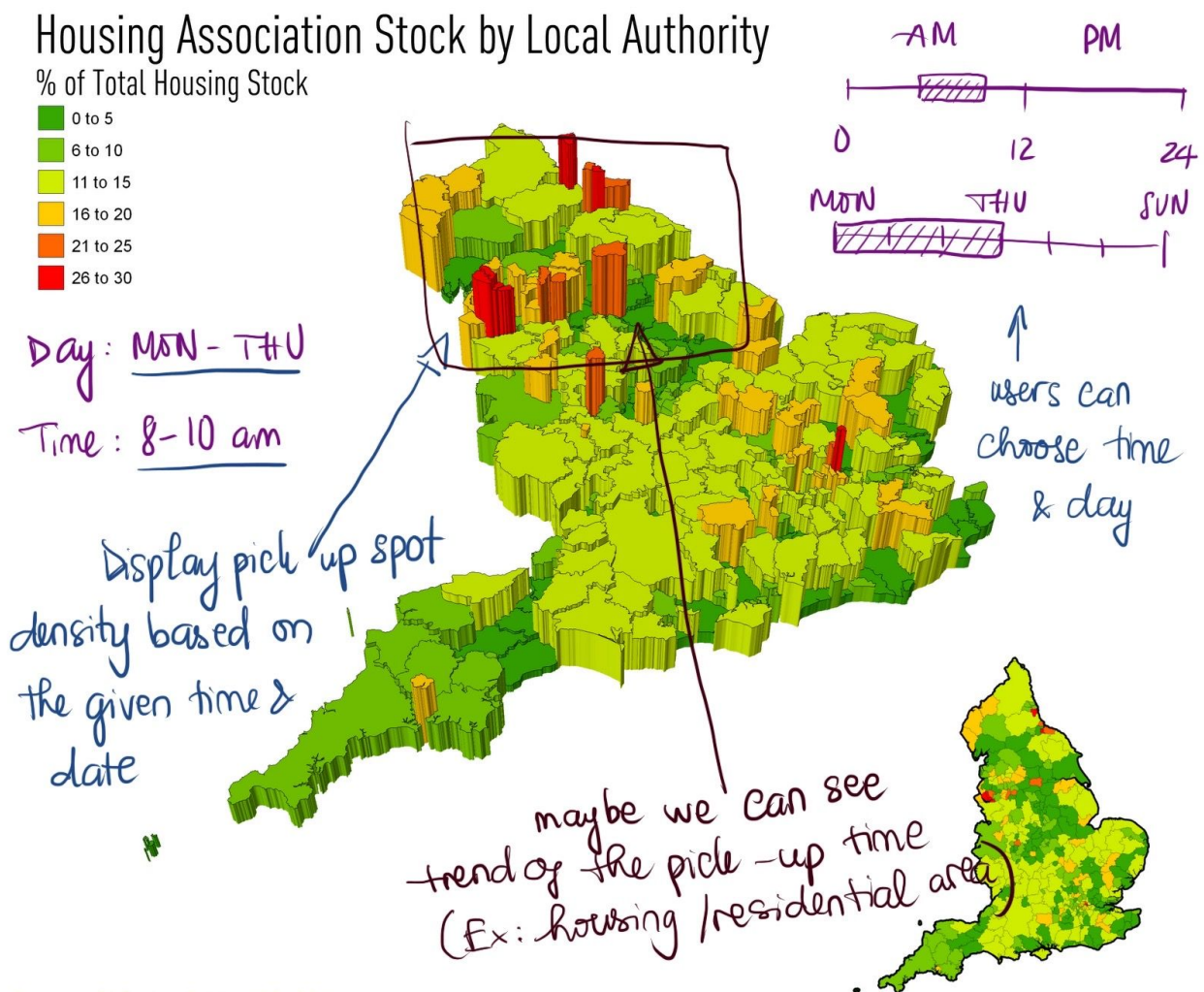this flat map can be used to denote → the cities / areas.

Source: CLG Live Table 100, 2011

- Pros & Cons:
    - Pros: Can easily get insightful information based on the color and height
    - Cons: Might be hard to incorporate all the different data together. For example, processing longitudes, latitudes, and location category
- Similar to the previous one:
    - You can use brushing on either Time or Days of the week. The uber pickup points will show up or disappear on the map based on brushing area. A click anywhere on the Time or Day of the Week axis will undo brushing.

- ○ The header on top of the map shows the selected Days and Time from brushing. By default it will be
  - ■ Days: All Days Time: All times
- ○ Any area of interest can be zoomed in by selecting a region. The zoomed map will be shown on the right side of the actual map. A click on the actual map will make the zoomed map disappear.
- ○ A tool-tip will show the details of an uber pickup point on mouse hover. Tool-tip will show all the details of all points if there are multiple pickups from the same location.
  - ■ Pickup points will be colored lighter or darker. The color intensity increases if a spot has many uber pickups.

Housing Association Stock by Local Authority
% of Total Housing Stock

- 0 to 5
- 6 to 10
- 11 to 15
- 16 to 20
- 21 to 25
- 26 to 30

Day: MON - THU

Time: 8-10 am

Display pick up spot density based on the given time & date

AM   PM

0   12   24

MON   THU   SUN

users can choose time & day

maybe we can see trend of the pick-up time (Ex: housing/residential area)
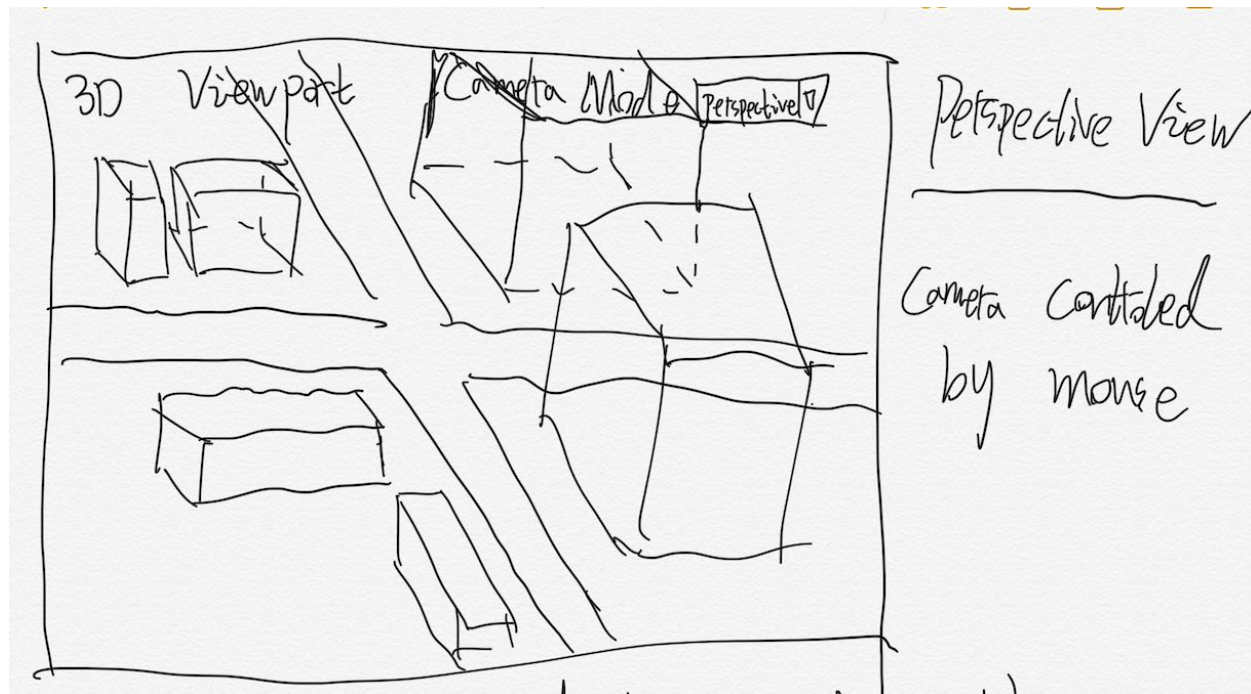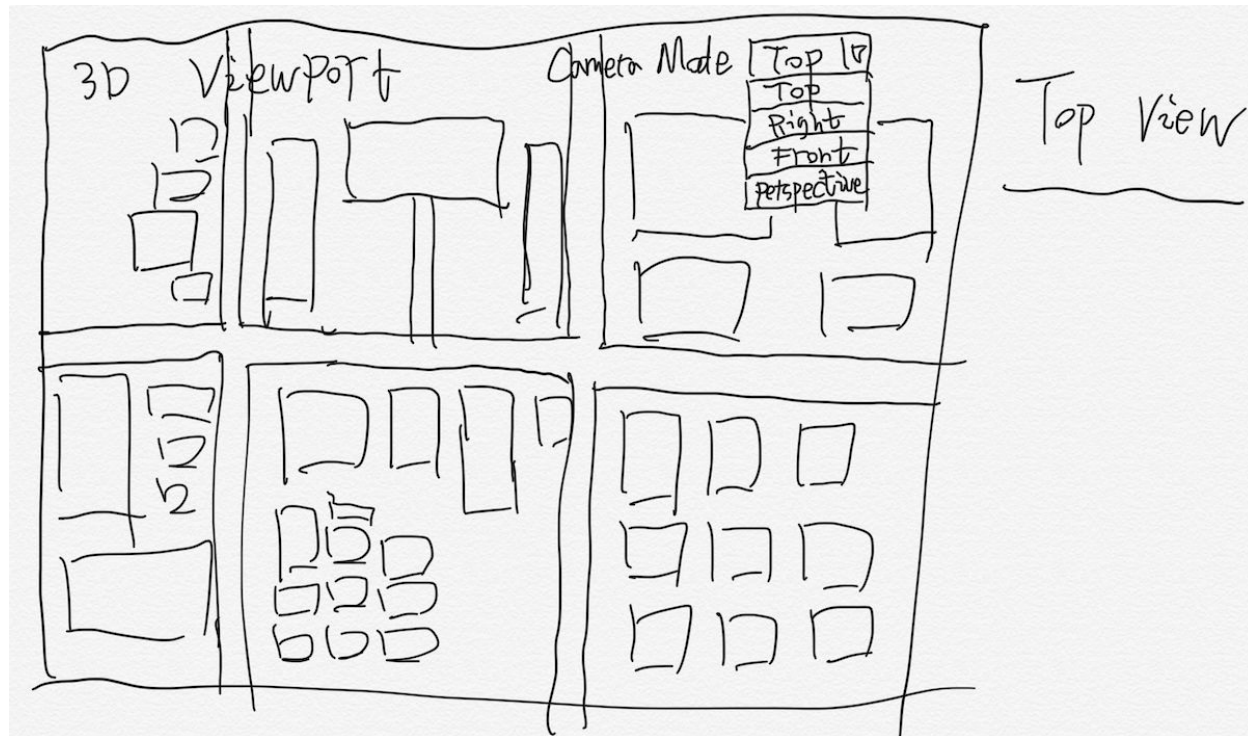
Source: CLG Live Table 100, 2011

Design 3:

● The third design is mainly different in the operation to choose which data to display in map and how to display in charts.
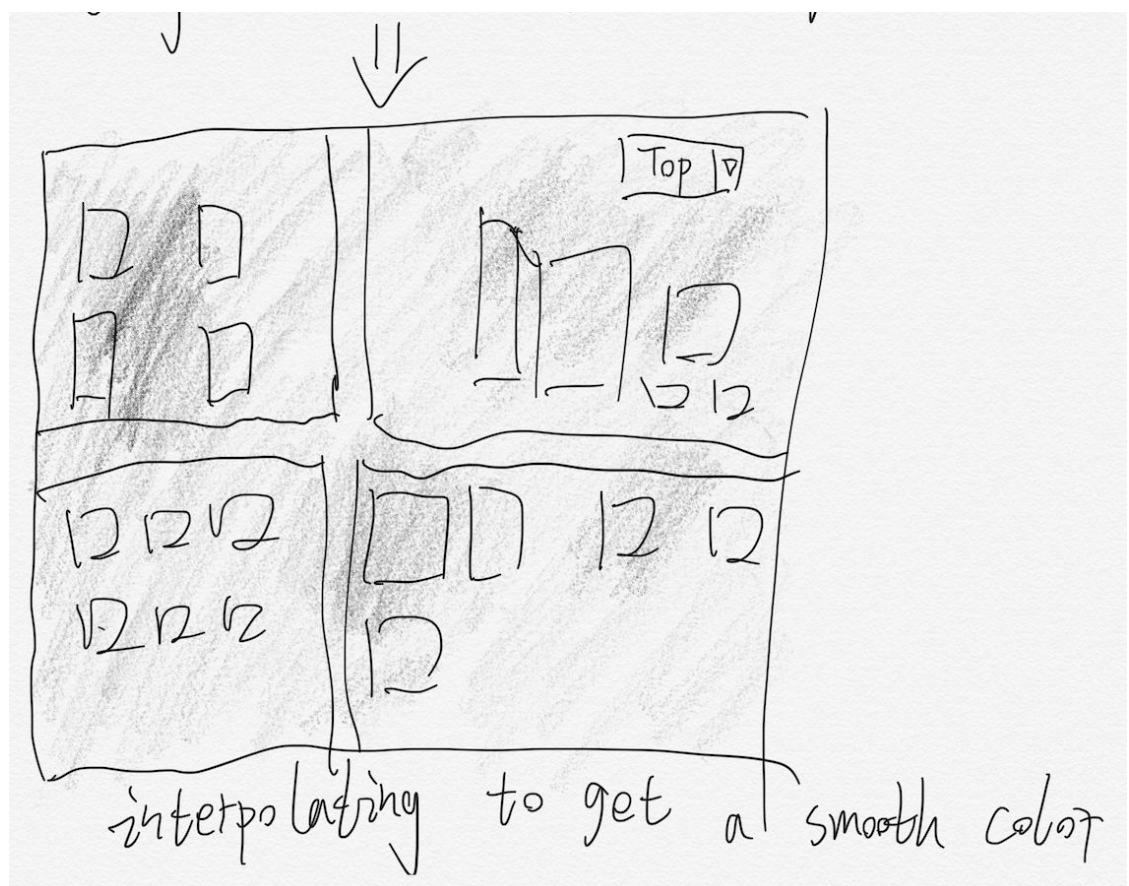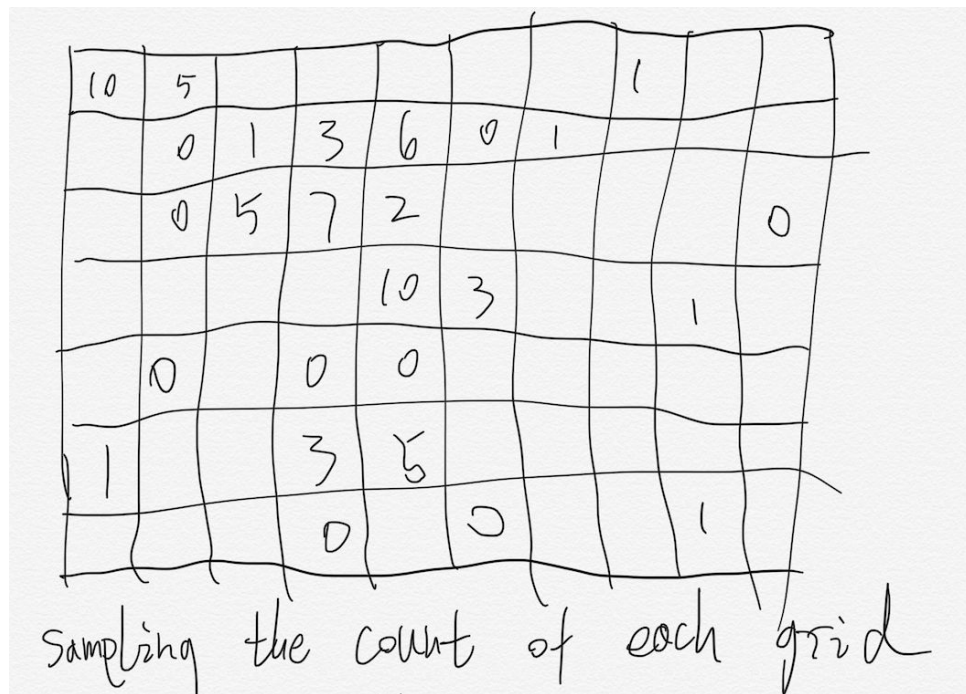 ○ Layout:
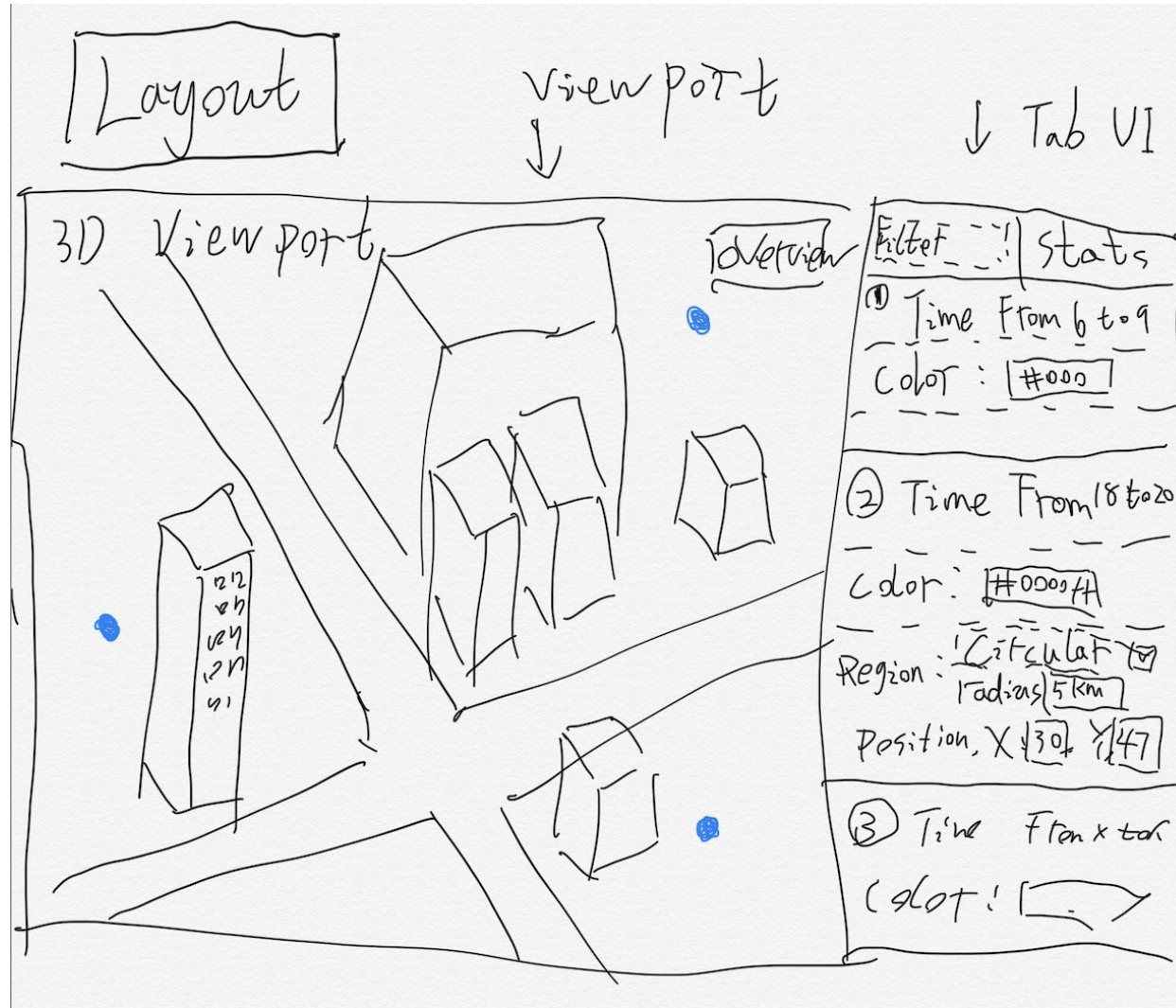
  ○ Pros And Cons
    ■ Pros: Flexibility for exploring data with different insight via different options.
    ■ Cons: Take more efforts to learn how to use the tools.
  ○ Focus

1. There are guide buttons to quickly set camera into a top view to get a flat map or into a perspective view to observe the city map with free direction and position.

3D Viewport

Camera Mode [Top ▽]
Top
Right
Front
Perspective

Top View

3D Viewport

Camera Mode [Perspective ▽]

Perspective View

Camera Controlled by mouse

2. Sampling the data rather than directly drawing the point.

sampling the count of each grid

interpolating to get a smooth color

3. Filters with rich options to display different data points.

Filter

┌─────────────────────────┐
│ (+) │
└ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ─ ┘

→ Press (+)
to add
a filter

Filter

① Color | #FF0000 |
(+)

Press (+) to add conditions

Filter

① Color | #FF0000 |

(+)
┌──────────────┐
│ Time │
├──────────────┤
│ Circular Region │
├──────────────┤
│ Rect Region │
└──────────────┘

→

Filter

① Color | #FF0000 |
Time (+) 6 to 9

② Color | #0000FF |
Time 17 to 29
(+)

③ Color | #00FF00 |
Circular region,
Radius 5km,
Pos X 13, Y 7

Viewport
5 km

Different Filters Can Display Simultaneously.
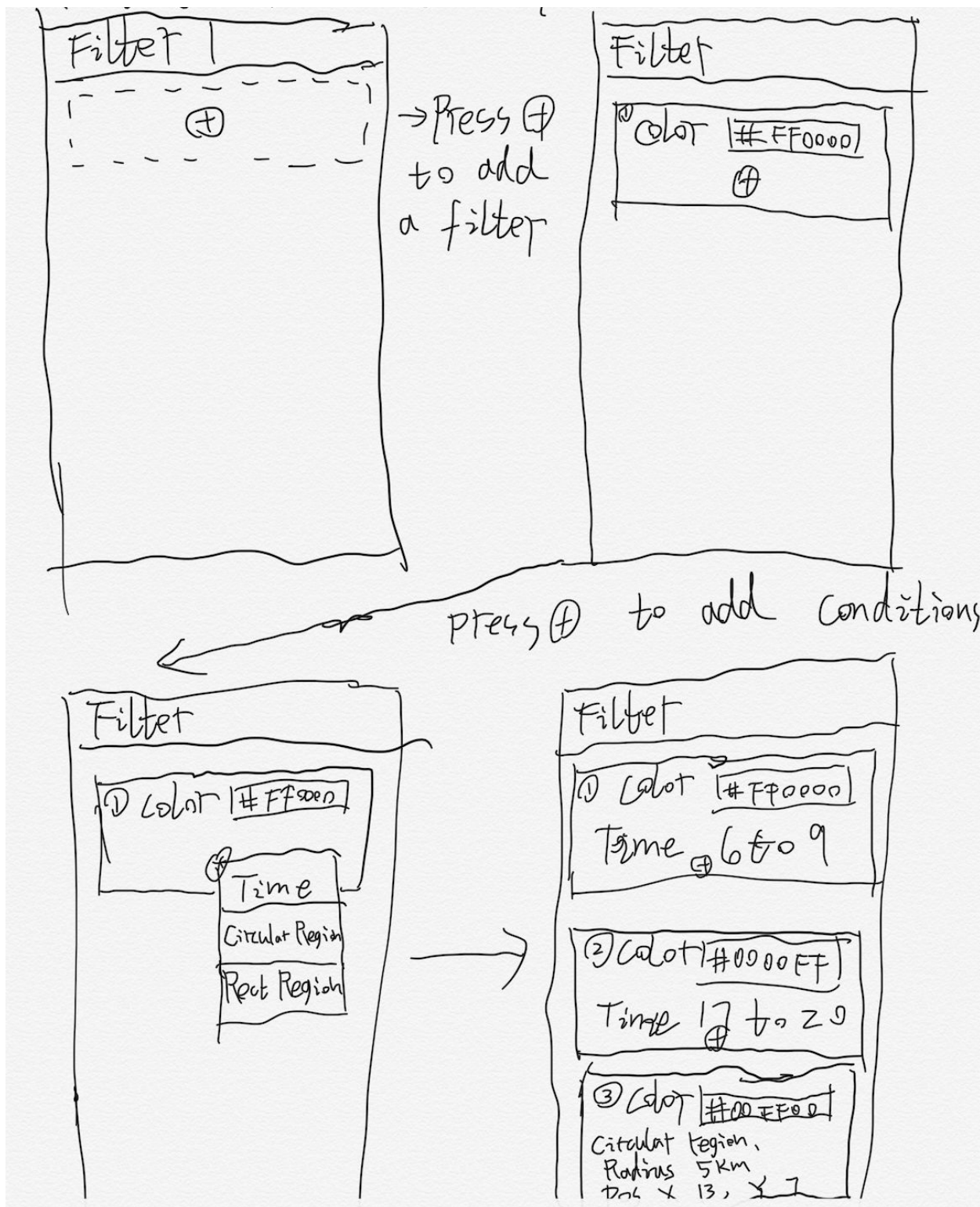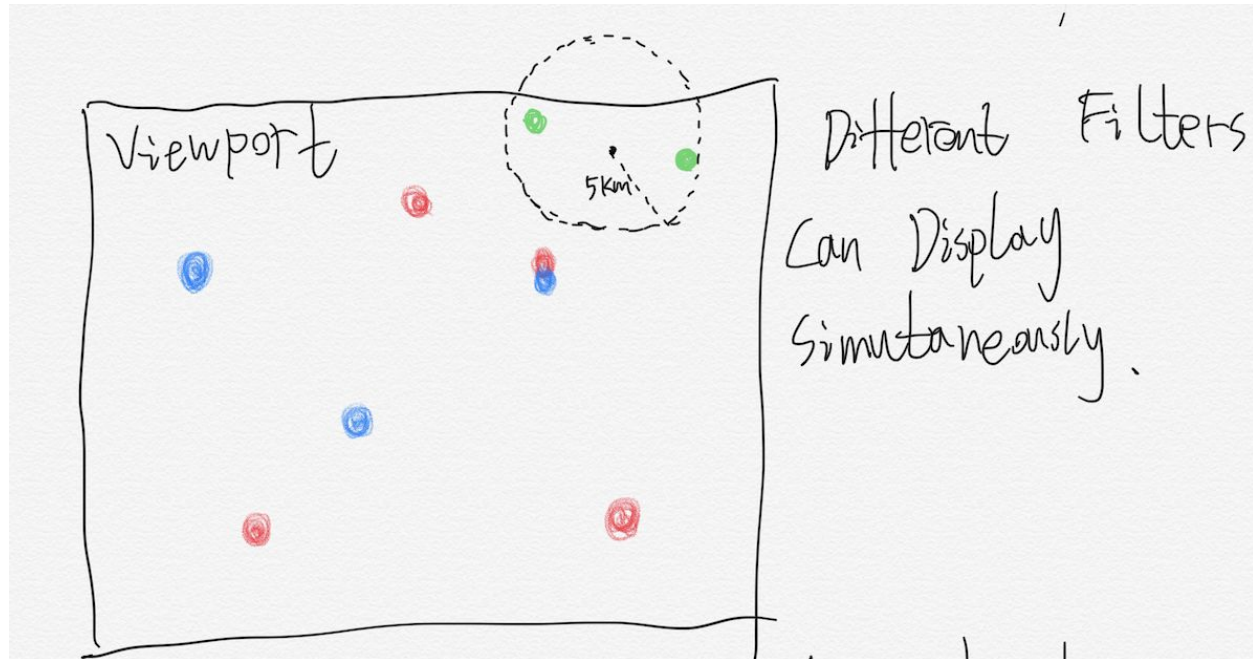
4. Support different types of charts correspond to different filters.

④ Support Different Types of charts Correspond to Filters

Filters | Stats
Dist by X ①
Dist by Y ②
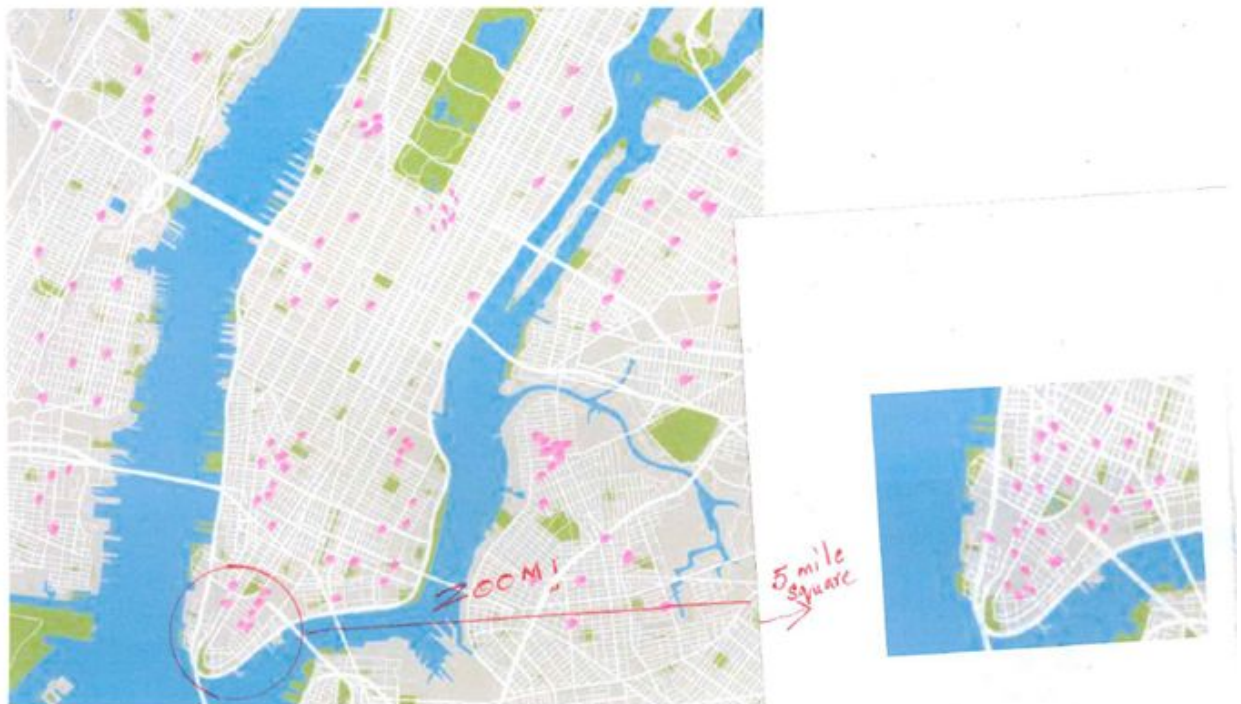Dist by time ③
0 ___ ___ 24
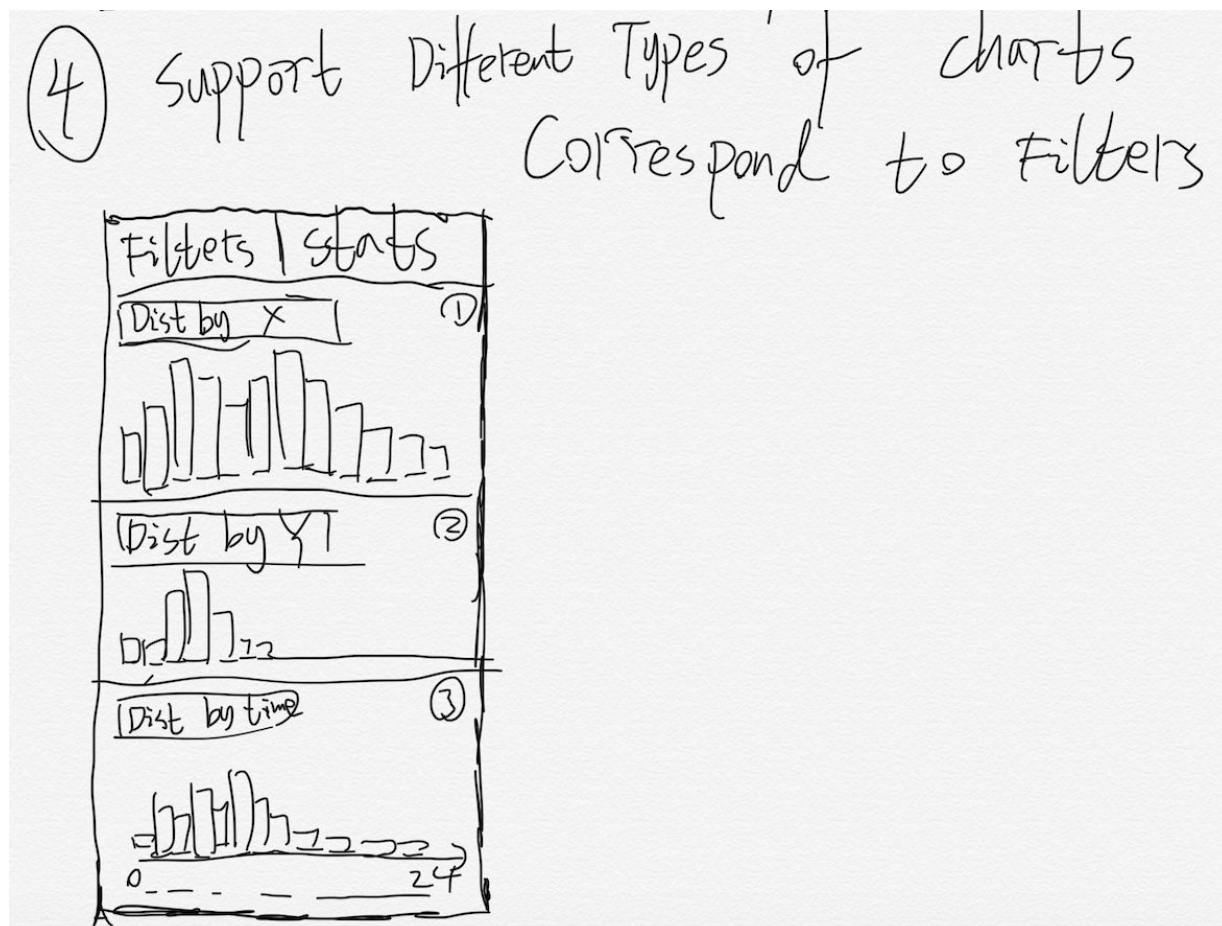
Final Design:

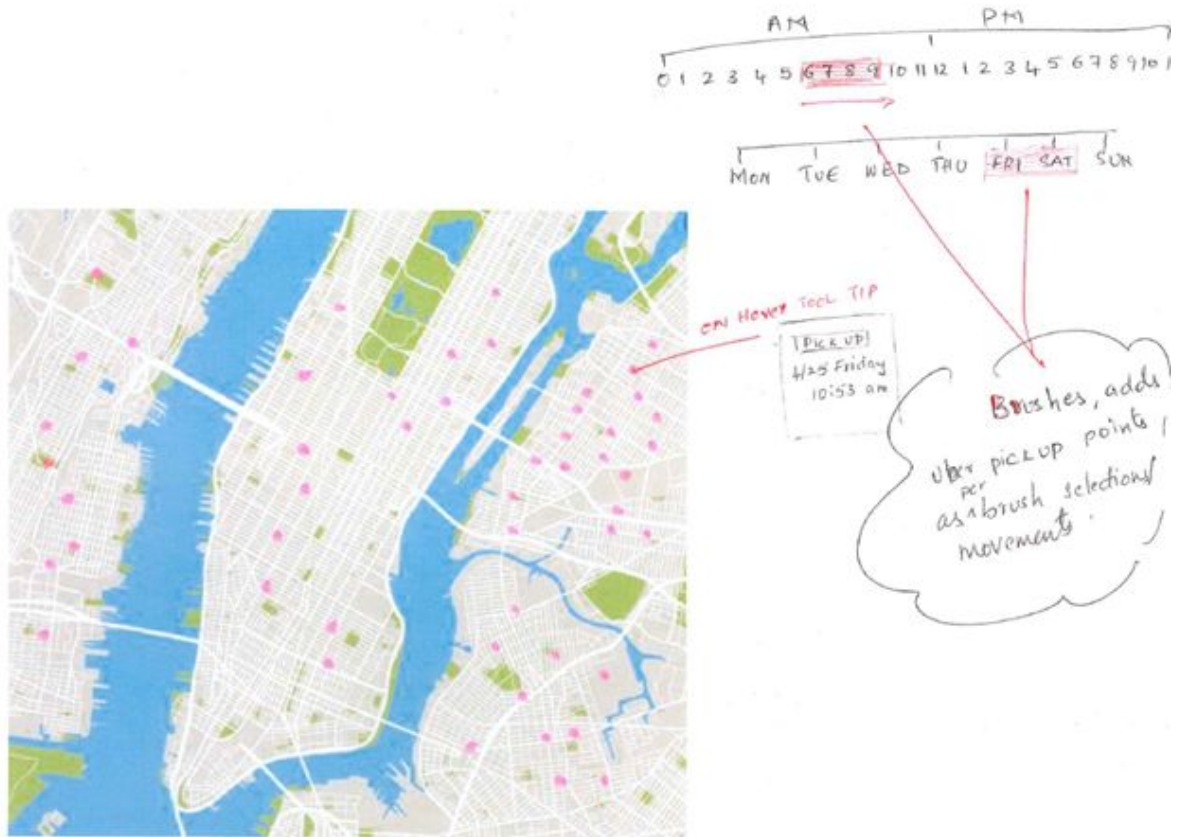The uber pickups will be visualized as follows –

·   All the pickup points will be placed on the New York City map as shown below -

·   You can use brushing on either Time or Days of the week. The uber pickup points will show up or disappear on the map based on brushing area. A click anywhere on the Time or Day of the Week axis will undo brushing.

·   The header on top of the map shows the selected Days and Time from brushing. By default it will be Days: *All Days* Time: *All time.*

·   Any area of interest can be zoomed in by selecting a region. The zoomed map will be shown on the right side of the actual map. A click on the actual map will make the zoomed map disappear.
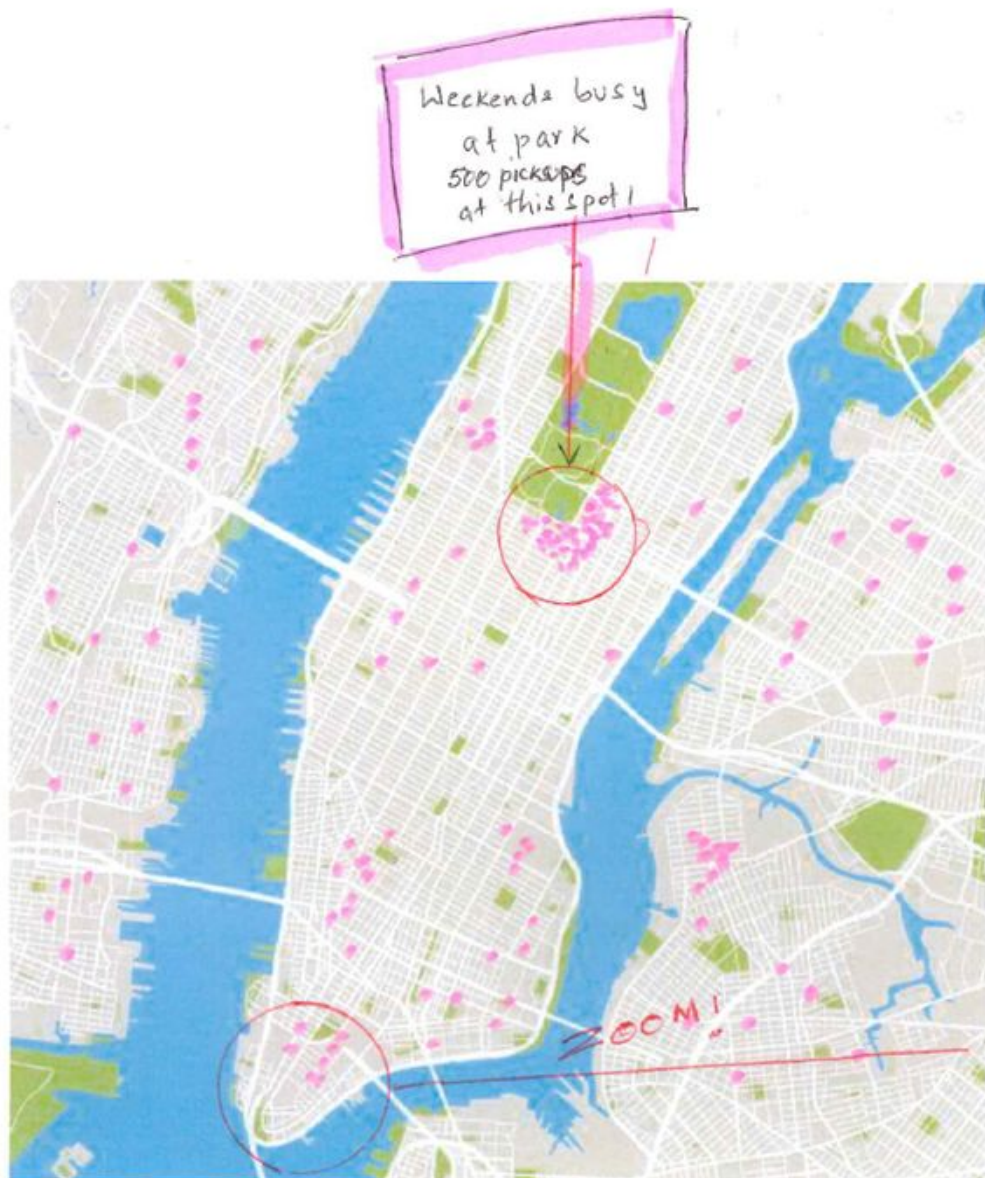
·   A tooltip will show the details of an uber pickup point on mouse hover. Tooltip will show all the details of all points if there are multiple pickups from the same location.

·   Pickup points will be colored lighter or darker. The color intensity increases if a spot has many uber pickups.

· Story telling - highlighting something interesting in the visualization!

- Support User-Defined Filters
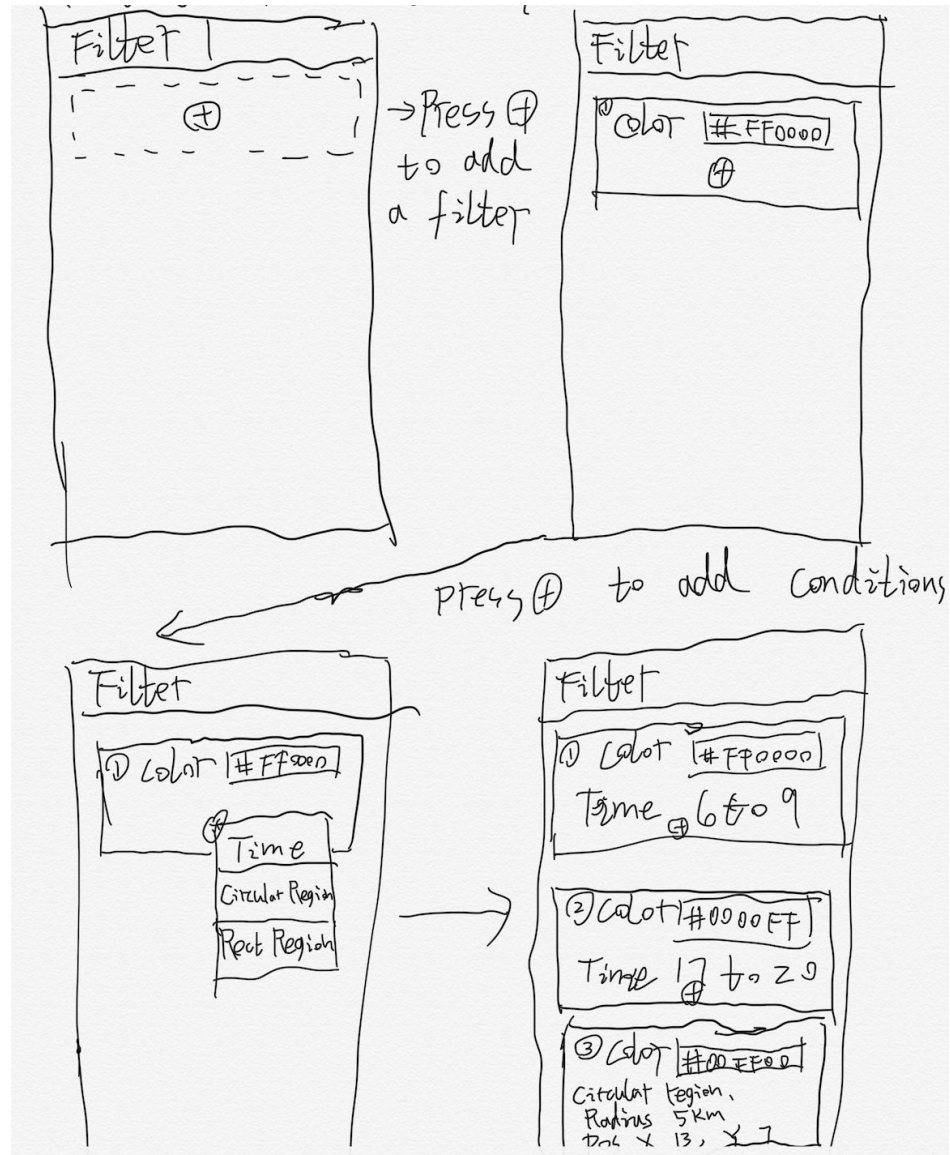
- Support User-Defined stats visualization that correspond to the filters

④ Support Different Types of charts
   Correspond to Filters

Filters | Stats

Dist by X   ①

Dist by Y   ②

Dist by time   ③

0 _ _ _ _ _ _ _ _ 24

· When the viewport is very large, sampling the data rather than directly drawing the point.

Sampling the count of each grid

interpolating to get a smooth color

NO.

DATE.

AM   PM

morning glory

0 1 2 3 4 5 6 7 8 9 10 11 --- 24

MON TUES WED THU FRI SAT SUN

PICK-UP DURING 6 - 8 AM

FROM FRI TO SAT

tool tip for
interesting spots
(story - telling)

DAY
☑ MON
☐ TUES
☐ WED

AREAS
☐ Queen
☐ Manhattan
☐ ....

Pick up points

.4K

MON TUE WED THU FRI SAT SUN

Pick - up - points

0 1 2 3 --- 12 1

Pick - up throughout day
for the whole state

Pick up point

0 1 2 3 4 ... 12 12 --

Pick up throughout a day
by areas

- Have more charts and histograms to show more relationship and information. We can have users choosing which areas they want to include for these charts (e.g.: Manhattan, Queens, etc.)
  - Use bar chart or line chart to show pick-up frequency throughout the week. It can show which date is most busy during the week.
  - Pick-up throughout the day for the whole week. (Example: the second chart in the picture above)
  - Pick-up throughout the day by areas (Example: the third chart in the picture above)

Must-Have Features.

- Map of New York City filled with uber pickups shown as circles. More number of pickups from a location, darker the circle color.
- Brushing on time and days of the week.
- Tooltip showing pickup point information.
- Header section showing the brushing Days/Time selections.
- Storytelling – highlighting something interesting in the visualization.

Optional Features.

- Zoom into a local region
- User-Defined Stats Visualization corresponds to User-Defined Filters
- Dynamic charts
- Encoding Category Data into our visualization
- 3D Map, 3D is complex and unjustified, need carefully design.

Peer Review. *from Tianlong Zhang, Pranav Rajan, Torin Mcdonold*

Questions. *some of the questions we got after we pitch our project to the other team*

1. How much can user zoom in? Would they be able to see the street view? – *No, there will be no street view.* *We can zoom in to see each area by zip code?*
2. geoJSON or Google Map API? – *geoJSON*
3. How to display a spot with a lot of pick-up? – *display all the dots within a certain distance at that spot OR use heat map?*

Feedbacks. *some feedback from the other team and professor Alex*

1. Keep a calendar for the month where uber data is present. Click on any day should show the pickup points on the map for that day.
2. Use button for story telling. Here are some examples
    a. Story telling suggestions - 30th has lot of pickups than any other day.
    b. Zip code xxxxx has most number of pickups.
    c. 8am - 9am is the busiest hour!
3. Don't use all 600K pickups. Sample 10K pickups for the project.
    a. Maybe randomize and pick out 10K pick-ups for 1 week.
4. Don't use 3-d maps if possible as it will be a little complicated.
5. We can color code by zip code.
6. Show each burrough separately on click event.
7. For the customized filter, it's not necessary to have an option for user to choose color because they think the user wouldn't want to pick the color. Instead, we should choose a default color scale.
8. Add brush on the map to show some property.
9. Add more histogram to display more relationship and information.
    a. Show the difference of pick-up frequency for each day of the week.
    b. Show the difference of pick-up frequency for each time frame.
    c. Show the difference of pick-up frequency based on the area.

Project Schedule.

Project Schedule					
Work item	**Week**	**Start Date**	**Planned Completion**	**Resource**	**Member**
Write the experimental code to check the possibility to get the category data vis preprocessing.	1	10/28/2019	11/3/2019		Tianyu Li
Build the basic structure of the project, Including some basic scripts files, html files, css files, necessary data structures.	1	10/28/2019	11/3/2019		Tianyu Li, Mia Ngo, Dayanidhi Tandra
Finish the layout part of the project so that then we can do different modules at the same time.	1	10/28/2019	11/3/1019		Tianyu Li
Start to do the different modules based on provided interfaces.	2	11/4/2019	11/10/2019		Dayanidhi Tandra, Mia Ngo, Tianyu Li
Process Book Writing	2	11/4/2019	11/10/2019		Dayanidhi Tandra, Mia Ngo, Tianyu Li
Map of New York City filled with uber pickups shown as circles.More number of pickups	2	11/4/2019	11/10/2019		TBD

from a location, darker the circle color.					
Header section showing the brushing Days/Time selections.	3	11/11/2019	11/17/2019		TBD
Brushing on time and days of the week.	3	11/11/2019	11/17/2019		TBD
Tooltip showing pickup point information.	3	11/11/2019	11/17/2019		TBD
Storytelling – highlighting something interesting in the visualization.	3	11/11/2019	11/17/2019		TBD
Zoom - Zooming into local region.	4	11/18/2019	11/24/2019		TBD
Code Review	4	11/18/2019	11/24/2019		TBD
Testing	4	11/18/2019	11/24/2019		TBD