

CityWays

Data, Web

POINTS!

Data Visualization Process/Skills
How technical/design problems were tackled

CityWays

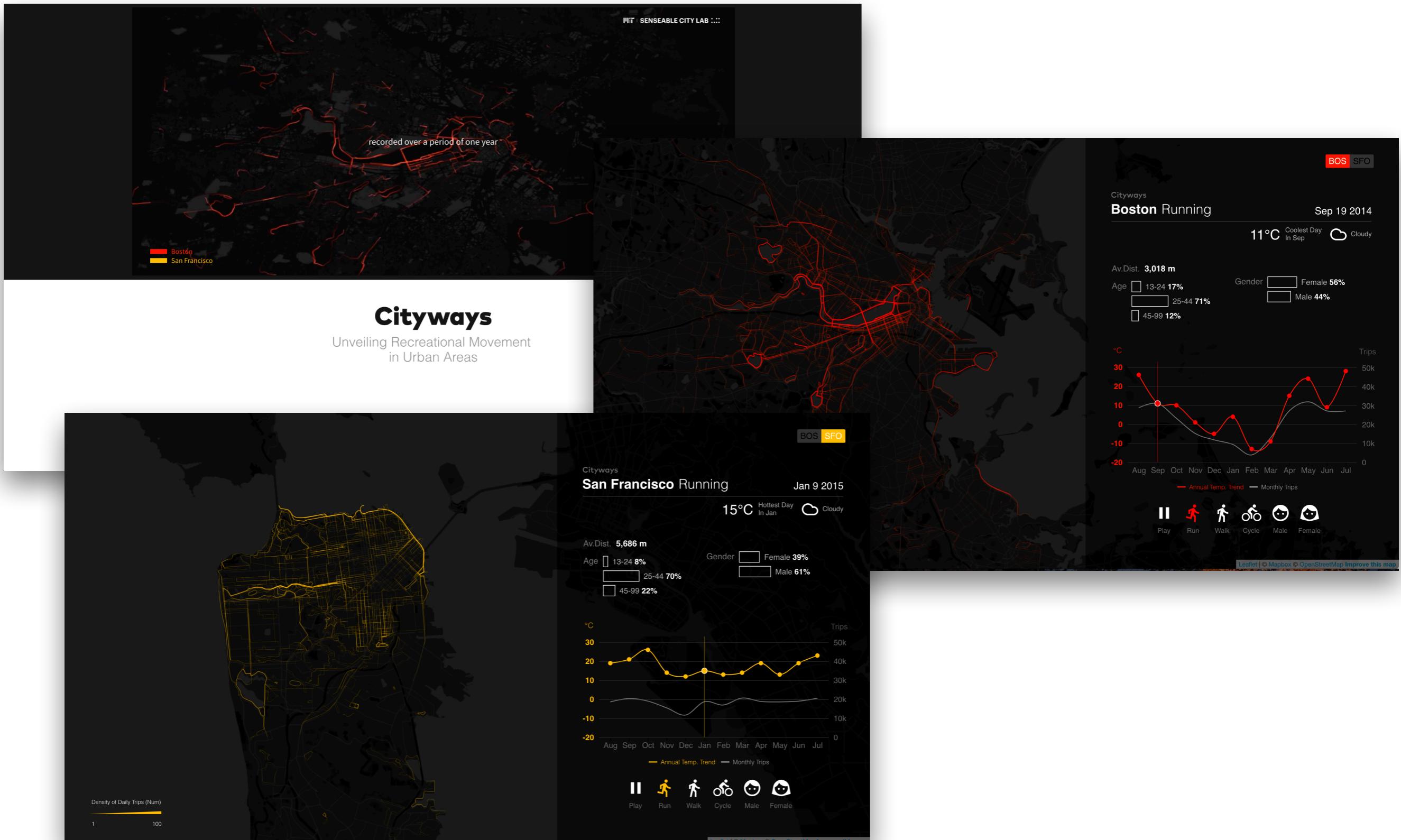
Type Web-based interactive data visualization, Commercial

Company MIT Senseable City Lab

Tool Javascript, Jquery, CSS, HTML, D3.js, Leaflet.js, Mapbox, Sketch, Adobe XD, Invision, AfterEffects, Photoshop/Illustrator

Team Carlo Ratti, Anthony Vandy, Paolo Santi, Fábio Duarte, Hyemi Song, Ruixian Ma

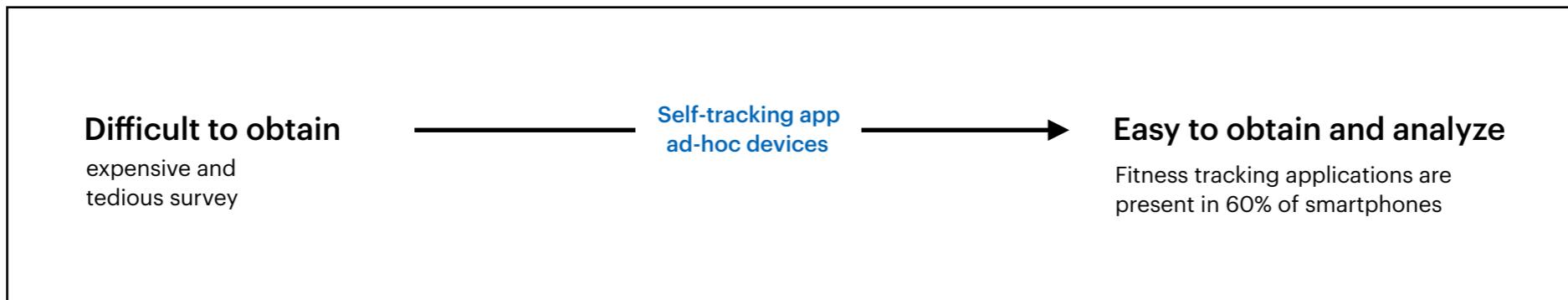
Role Design / Development



Understanding walkability

in cities has been a long standing area of research, with impact
on urban health and real estate values- among others

Movement Data



Self-tracking app Data



Research Goal

Analyzing billion of data from self-tracking apps to unveil how we walk and run in urban areas.

As a first step we were able to quantify the effects of temperature, precipitation, and other environmental factors on outdoor activities.

Visualization Goal

(Explanatory, and partially exploratory data vis)

How to convey the research insights to users through visual languages, allowing them to have their own suppositions and questions.

How to find unrevealed discoveries through visualizing the given data.

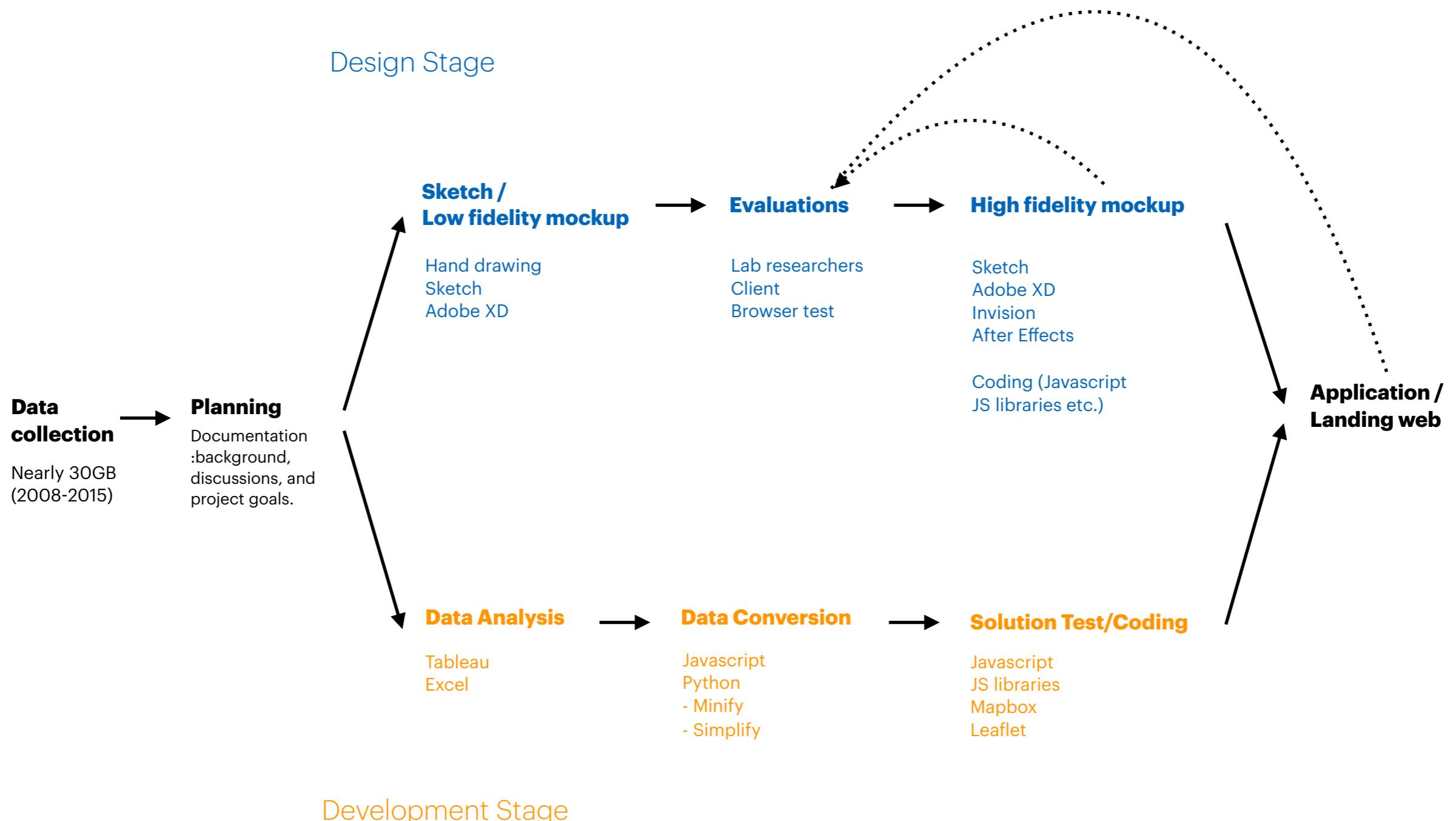
Target Audience

General Public who are interested in Urban studies done by MIT
Senseable City Lab / Mobility

Outcome

Landing website: Conveying overall information of cityways
(Description, Maps, Information)

Application: Enhancing users' understanding by allowing them
to explore data through manipulating the interface



Data

The size of data is big

- Selecting sample data

How to aggregate weather data?

Why SF and BOS?

- Which city is more important

Development

How to increase the performance of outputs for web?

- Simplifying data
- Minifying data
- Segmenting data / interaction flow

Animated Data Visualization

Design

How to allow users to compare BOS and SFO?

How do users understand annual recreational patterns in each city?

- Color
- Typeface
- Layout
- Main Objects
- Interactivity
- Motion

Base Map

- Background Color
- Labels
- Interactivity
- Zoom/out
- 2D/3D

Data

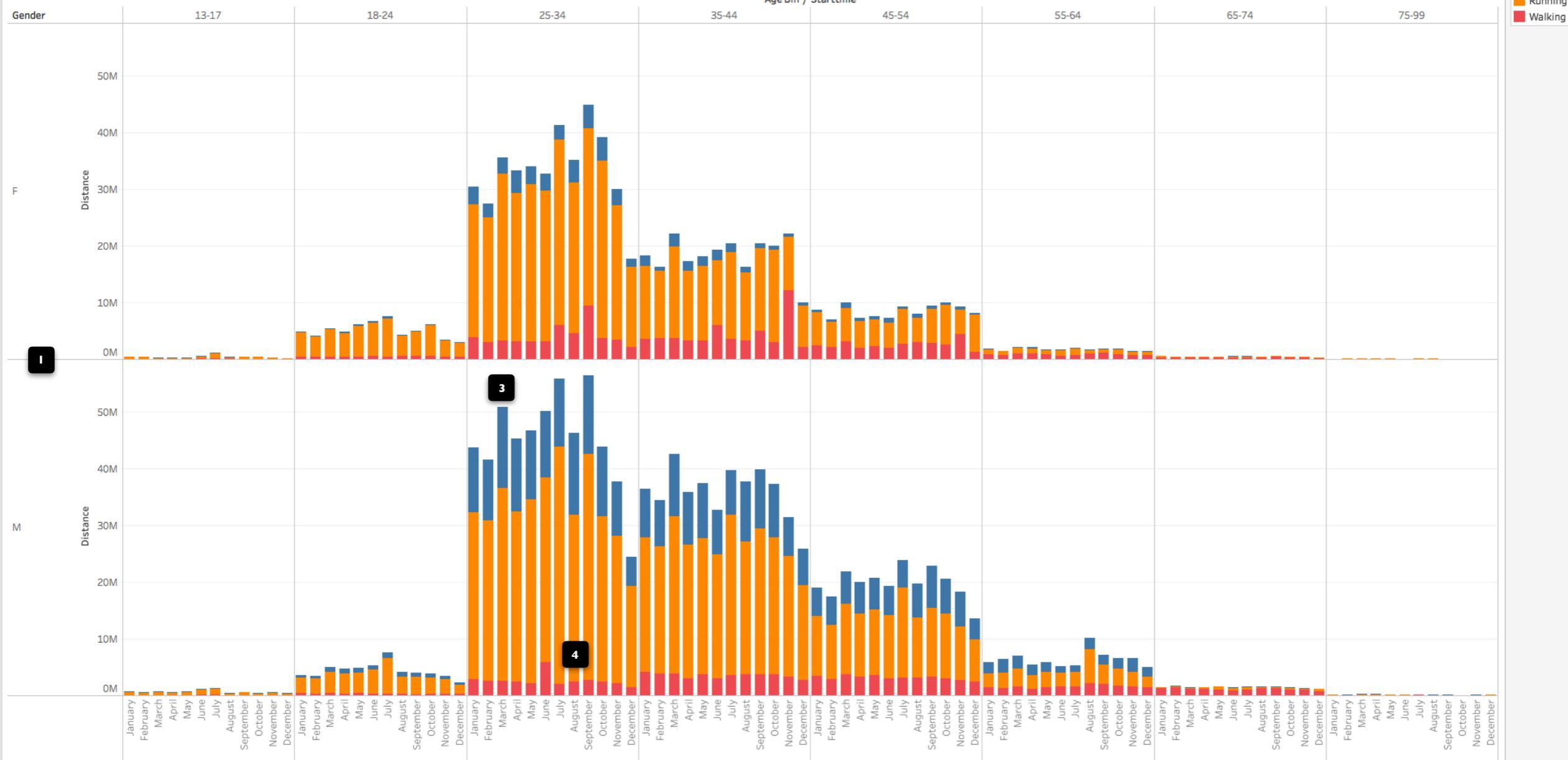


Main Information:

- + Demographic information
- + Weather information
- + Density of movements on Map

CityWays > Data > Demographic Information > Analysis Summary files (Tableau/Excel) > 2014.7 ~ 2015.8 in BOS > Distance

Sheet 2



1 Movements in Boston (Graph patterns) seems to be affected by sessional factors.

2 Male is a bit more active than Female. (The gap is larger than num of trip-based result)

3 20-40 aged people are the most active groups.

4 Male enjoy cycling than Female. Female prefer walking than cycling compare to Male.

5 People prefer late spring and early autumn for going out. (Statistic bar in Aug is lower than before/after the season)

Trip Data

Data in 2014/15 (SFO/BOS) — [Analysis / Discussion](#) → **Distance > Gender, Age, Triptypes**

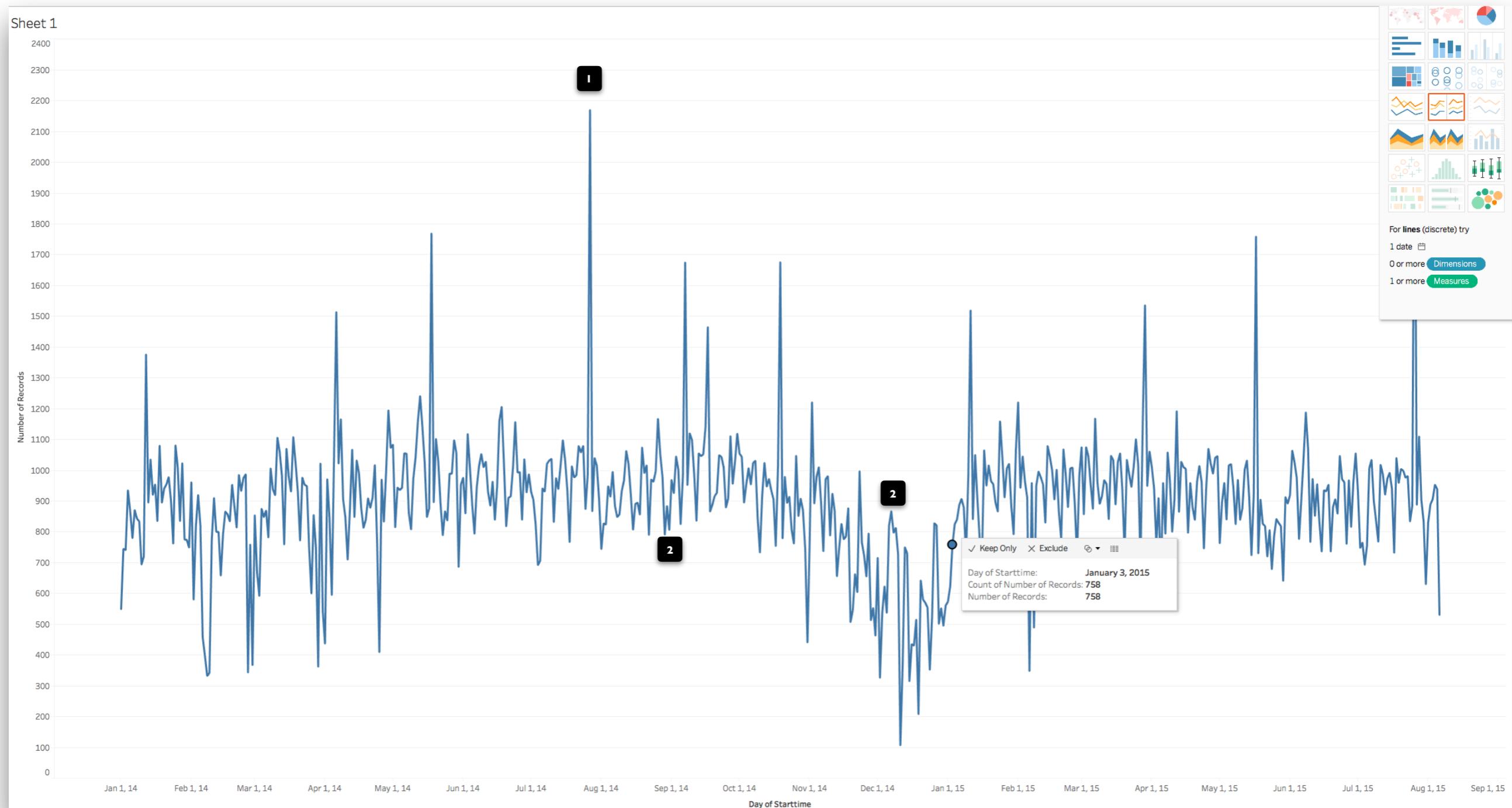
[For Demographic information](#)

Question

Should we use 365 days' data to show
the co-relationship between weather and trip trend?

CityWays > Data > Selection

The trip trend is affected by many factors, not only weather. (ex: Weekends, Events, Presence of restaurants and grocery stores etc)



- 1 There are significant peaks over the year. (Weekends or holidays)
- 2 One day in Jan (cold) shows the larger number than that of a day in Sep (warm)

Answer.

Explaining everything about all anomalies
by increasing the accessibility to all data

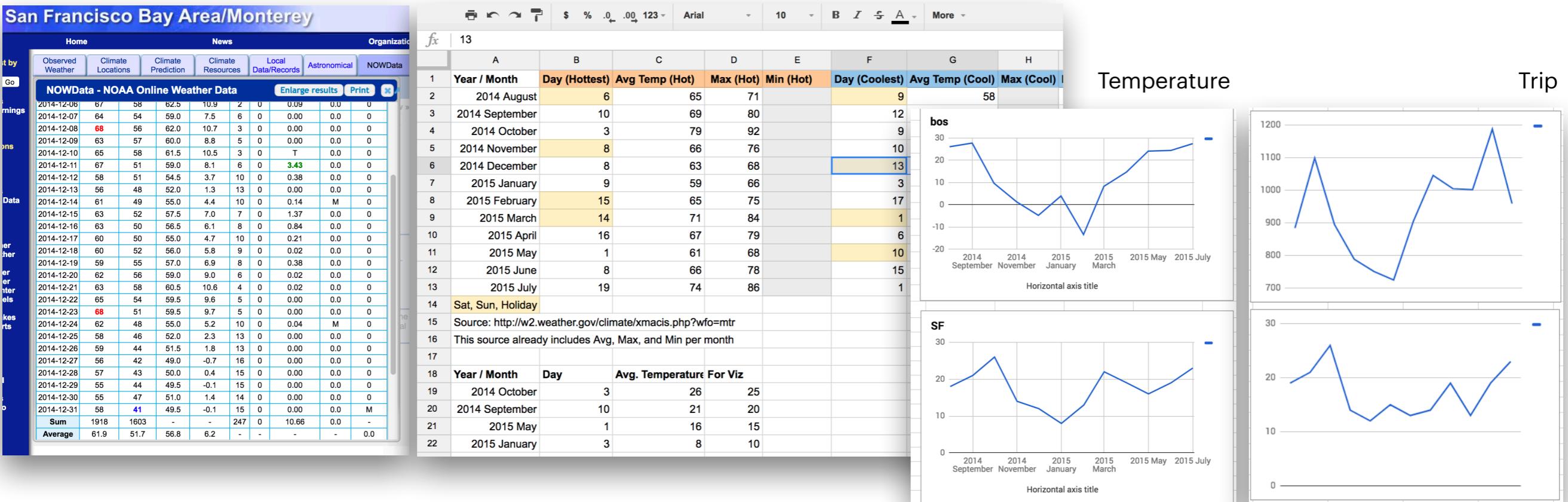


Increase the complexity



Decrease the performance
of web application

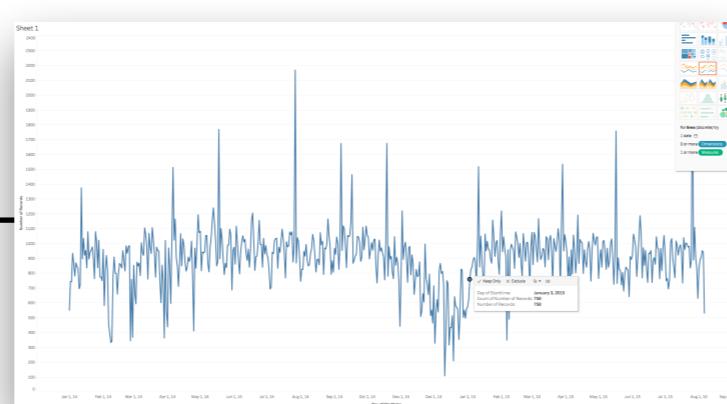
**Selecting core data
(related to weather)**



Every Month: Days that have Coolest, Hottest Temp (No Holidays)
Selected Days : Average Temp (Hottest/Coollest)

Selecting sample days

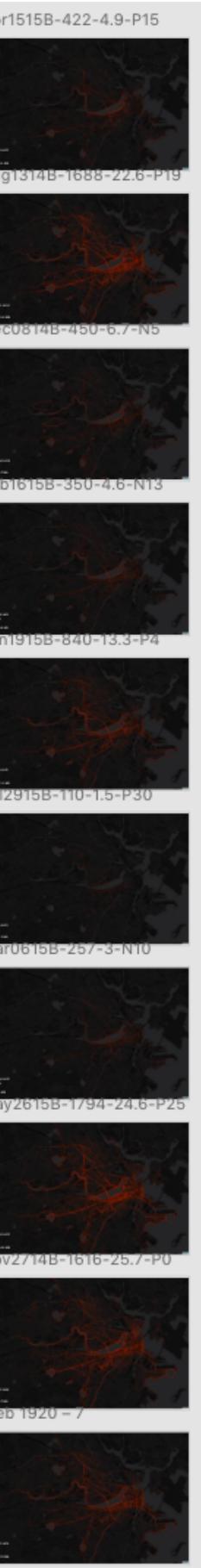
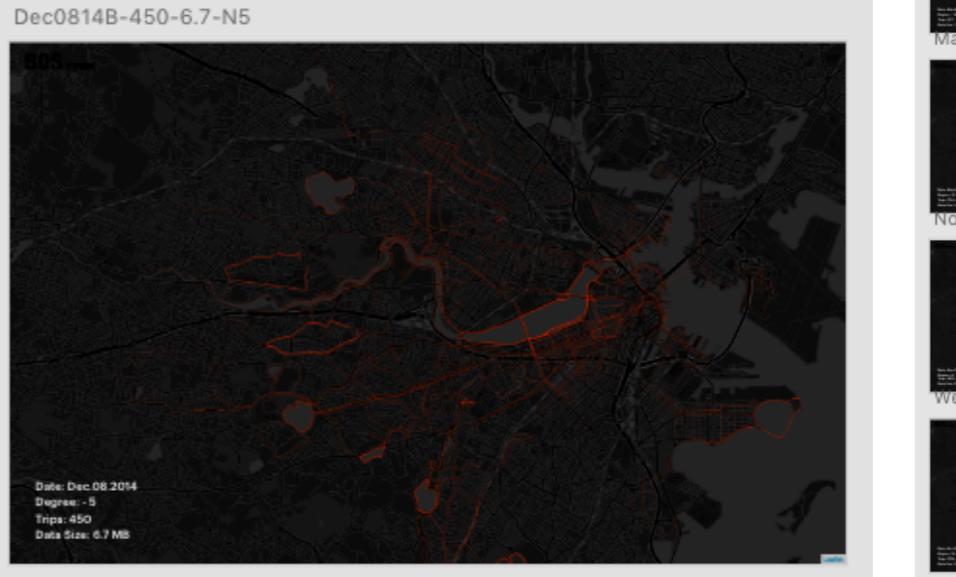
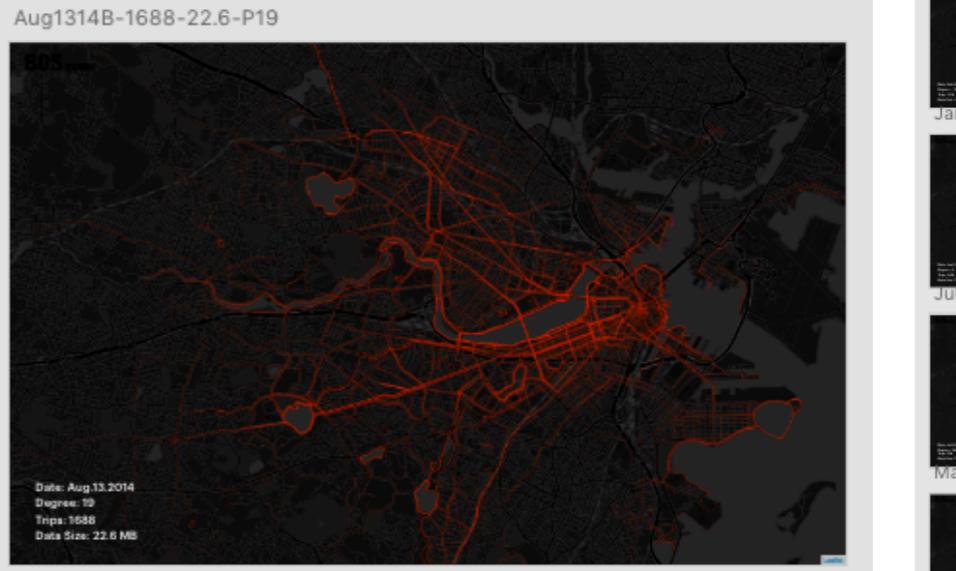
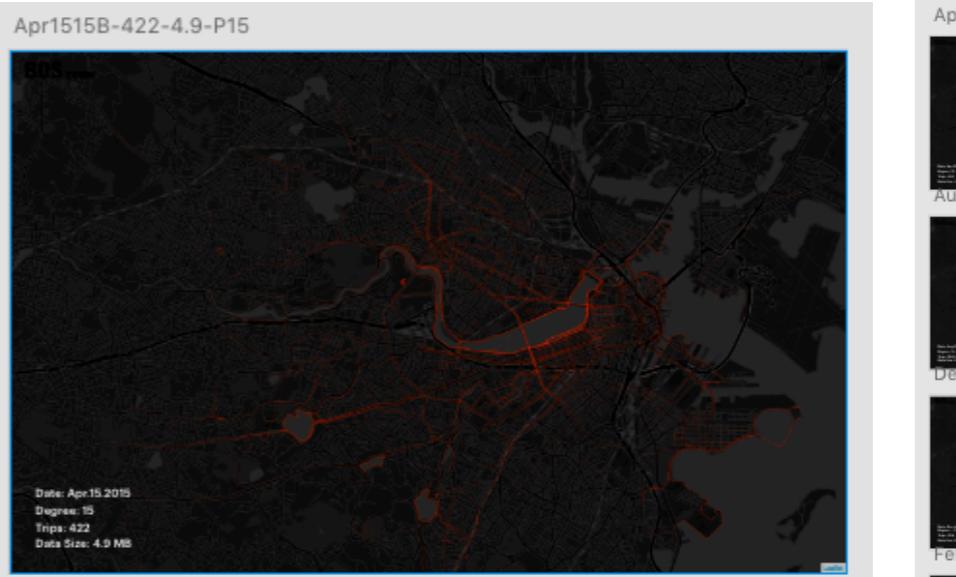
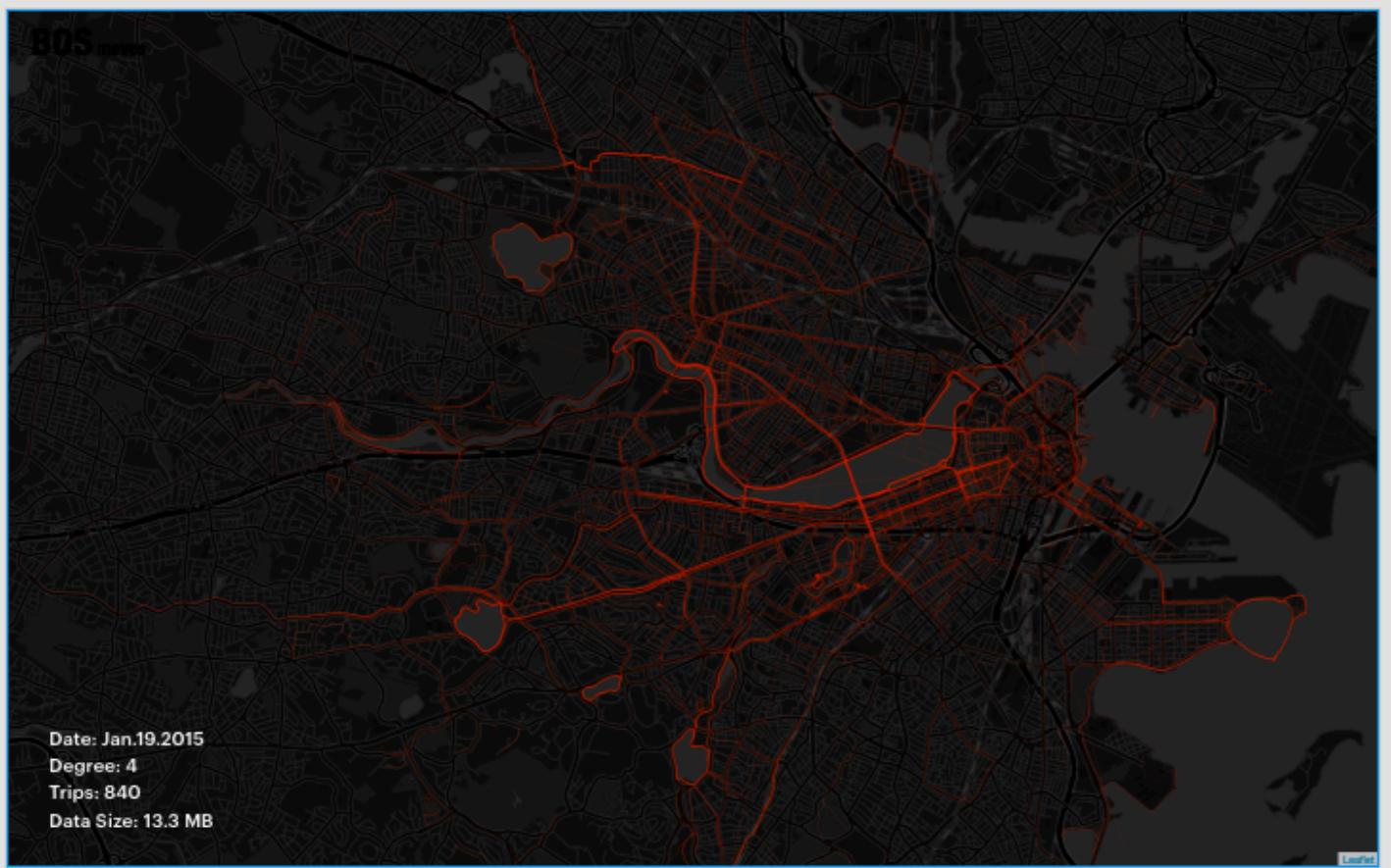
Comparing with
Mapping patterns



Trip Trend in 2014-15

12 days for each city
Temperature
Weather condition

CityWays > Data > Weather > Mapping Patterns



Development

Increase performance for web

Animated Data Visualization

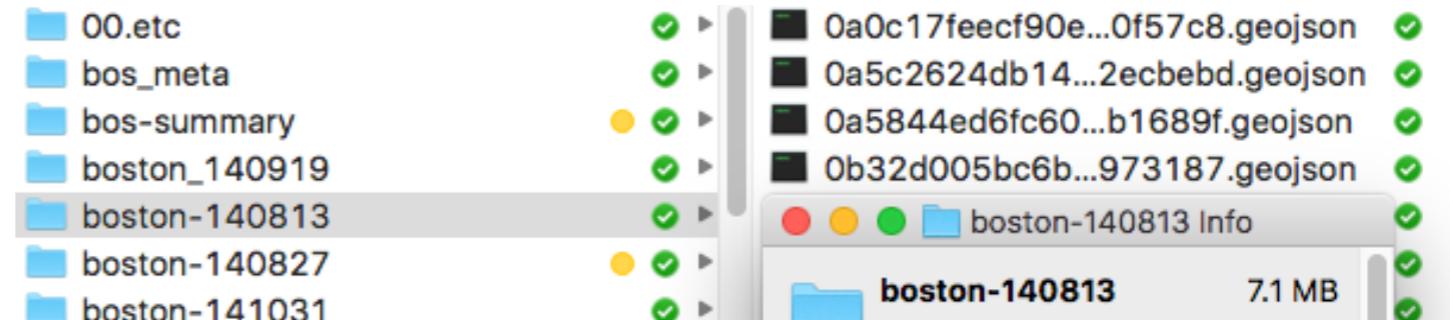
30 GB for BOS/SFO
(2 Summary files and many Geojson files)

1 Summary file for a city

A	B	C	D	E	F	G	H	I	J	K	L	M
hashed_user gender	age_bin	hashed_trip triptype	device	entrytype	starttime	endtime	utcoffset	distance	elapsedtime	totalsteps		
790169e056 M	25-34	84f87deb59c Running	android,ghos GPS	8/7/15 6:18	8/7/15 8:14	-4	13404.8328	7059				
29a1b93b80 F	35-44	2bea58c5d3c Walking	iPhone,iPho GPS	8/6/15 19:48	8/6/15 19:59	-4	792.216283	614.058				



Geojson files



Python



1 json file Max 26MB

```
boston-140813.json *  
1 [{"ag": "25-34", "dis": 3535.412226, "dur": 755.584, "end": "8/13/14 0:14", "gen": "
```

JS Minifying/Simplifying/Segmenting



5 json files Max 1MB

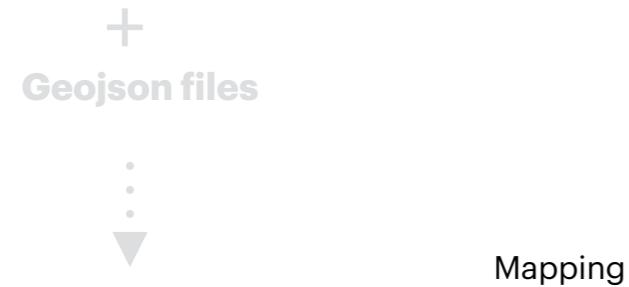
JS 12 months, 2 cities



12*5+12*5 = 120 json files

30 GB for BOS/SFO
(2 Summary files and many Geojson files)

1 Summary file for a city



Long loading time / Low performance

Discoveries by test

1. Size of data for the initial loading
2. Size of data for DISPLAYING on the map
3. Num of GPS nodes affects the size of data
4. All GPS nodes shouldn't be displayed for showing the density of trajectories

Solutions

1.
Eliminating number of GPS nodes



2.
Chopping data files into small files along to detail interactions
: minifying the size of data per single data loading / displaying

1 json files → 1 json files for A interaction/animation
1 json files for B interaction/animation
1 json files for C interaction/animation
1 json files for D interaction/animation
1 json files for E interaction/animation

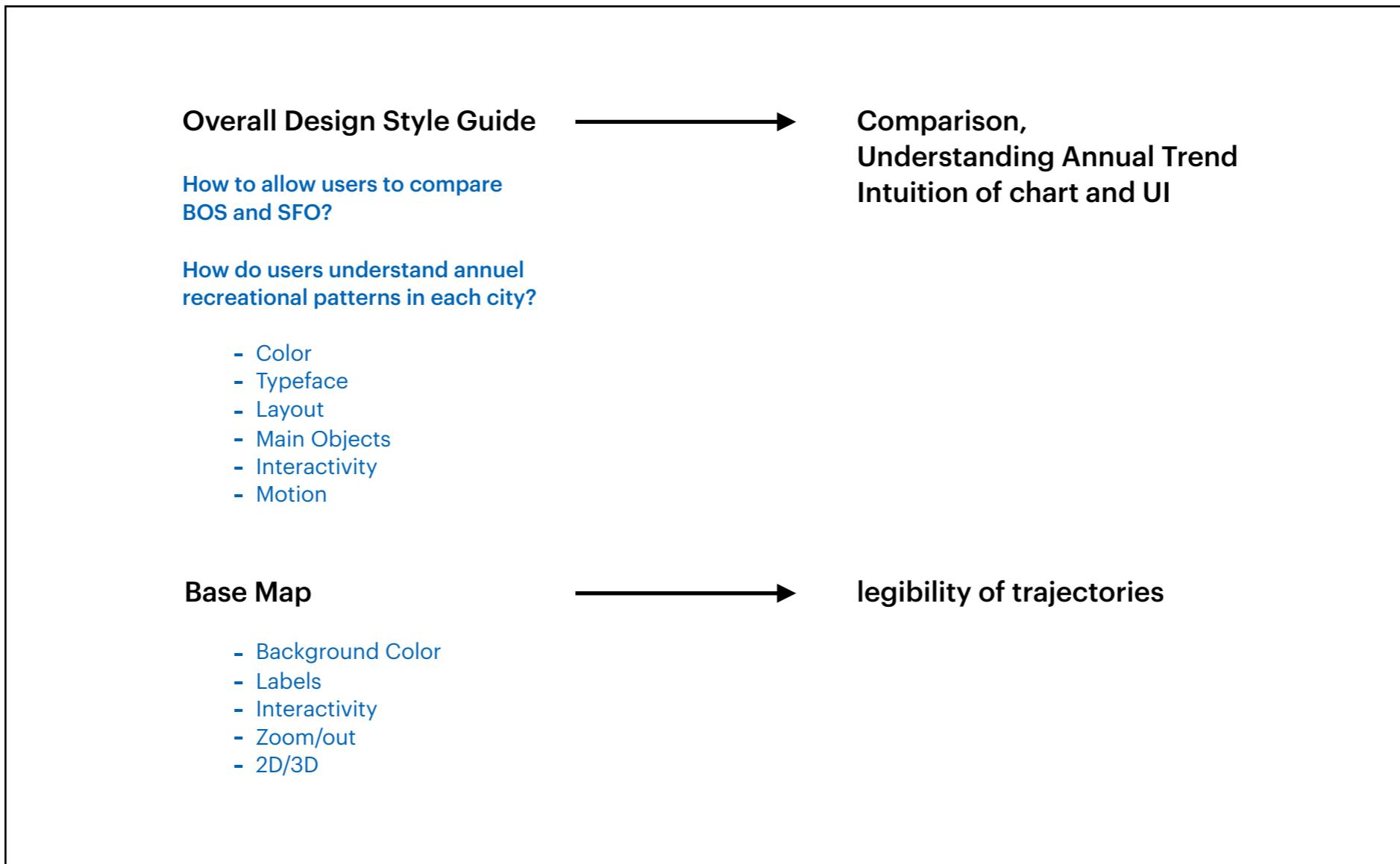
3.
Removing trajectories when the relevant interaction/ani are no longer activated

5 json files Max 1MB per 1 file

⋮
12 months, 2 cities
↓

12*5+12*5 = 120 json files

Design



Color Set



#FF3B00 #FFC200 #000000

#FFFFFF

Warm color spectrum: It implies Data Vis is related to temperature
Red for BOS: It shows that BOS is more important for the research
Yellow for SFO: It illustrates SFO is less important than BOS
Gray Scale: It emphasizes main vivid colors.

Mark Pro for Title

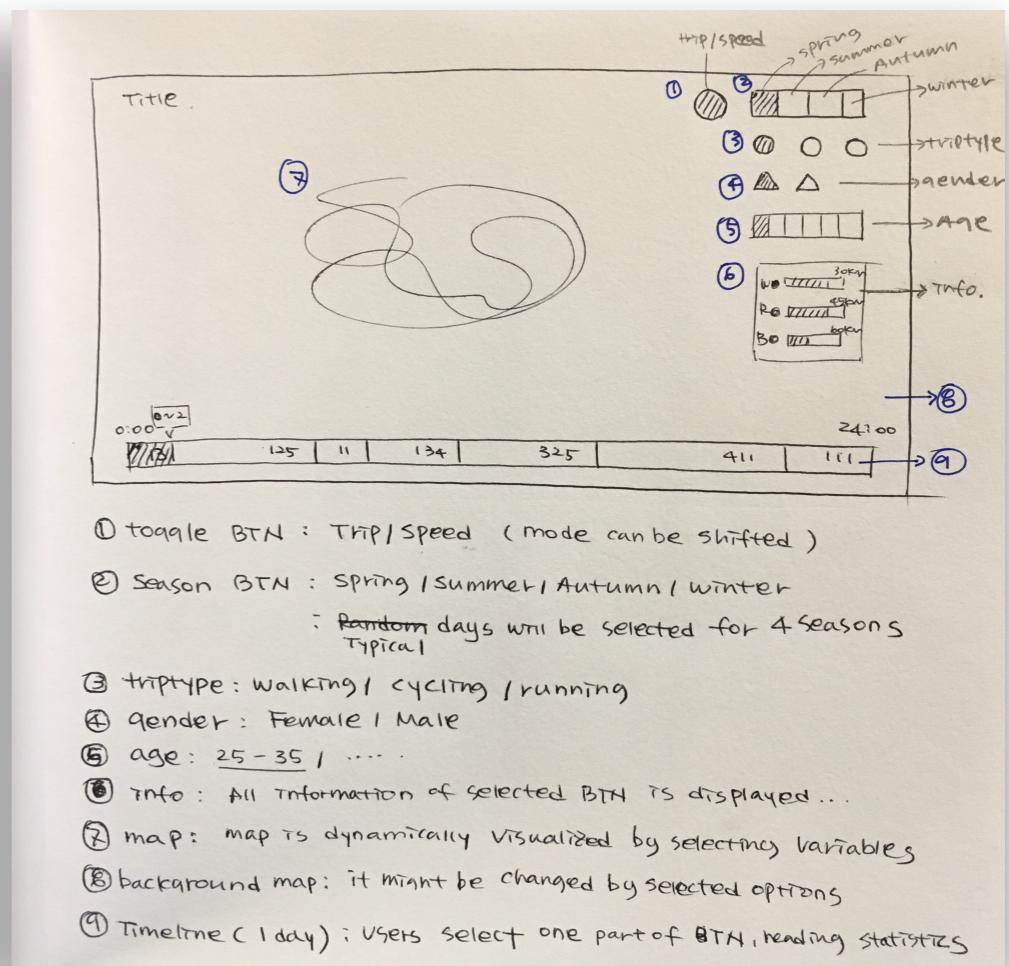
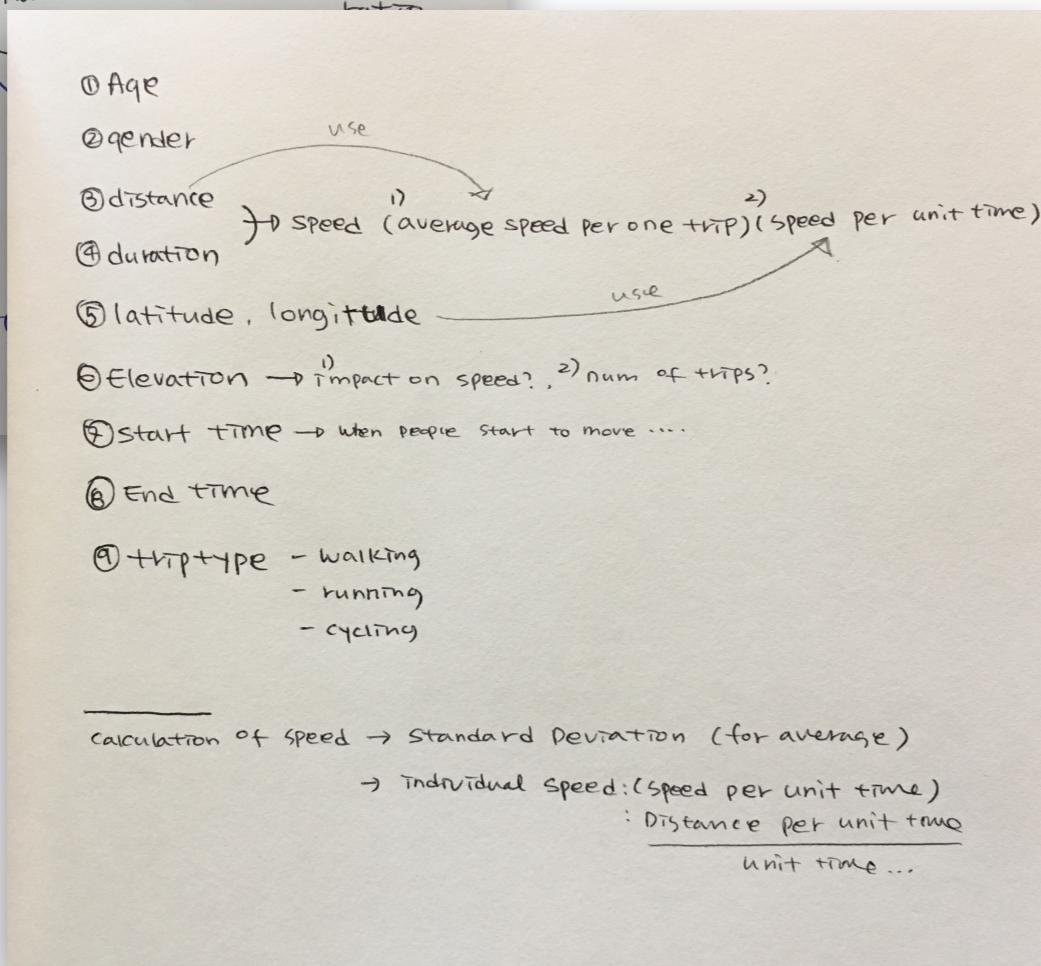
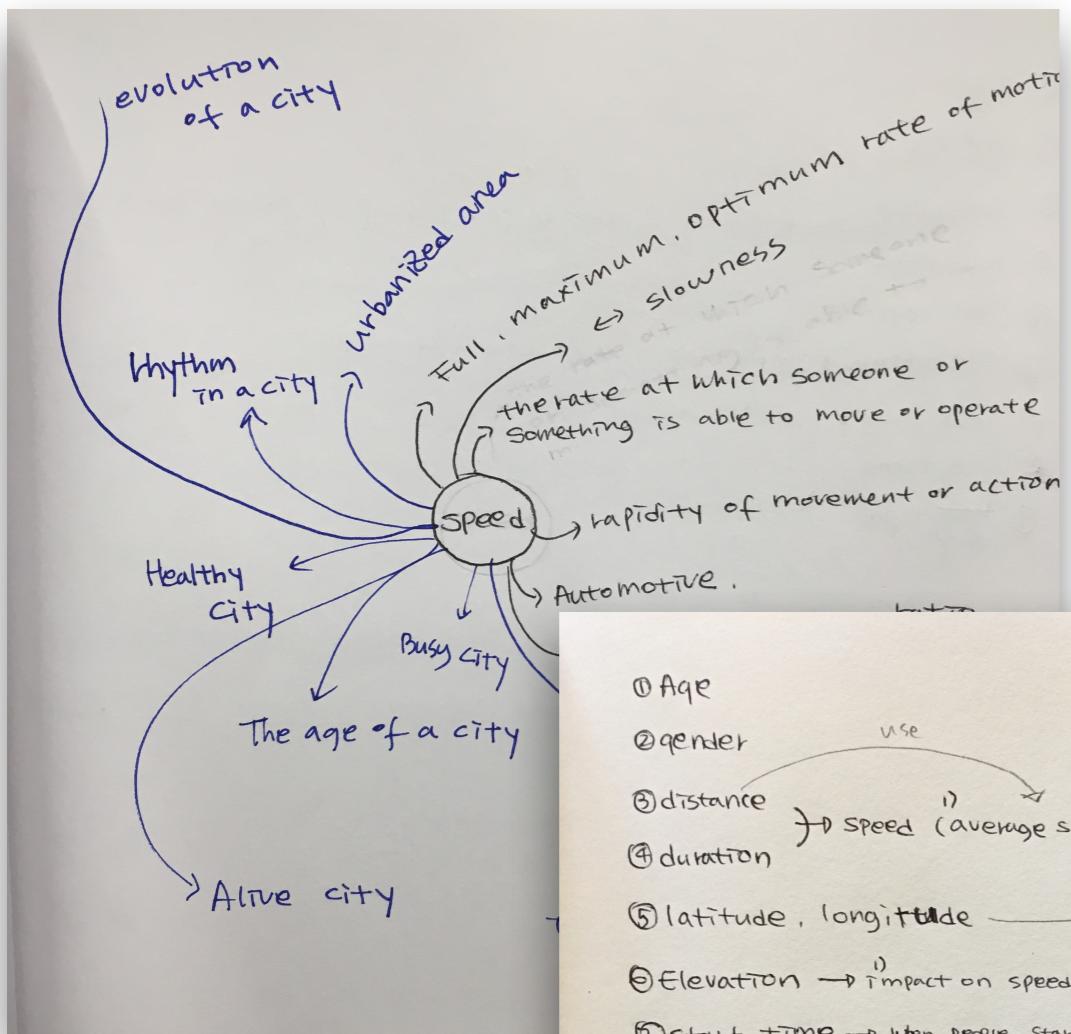
ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz1234567890!@#\$%^&()

Rounded, box shape, geometric tradition
: Good to highlight a title and headline

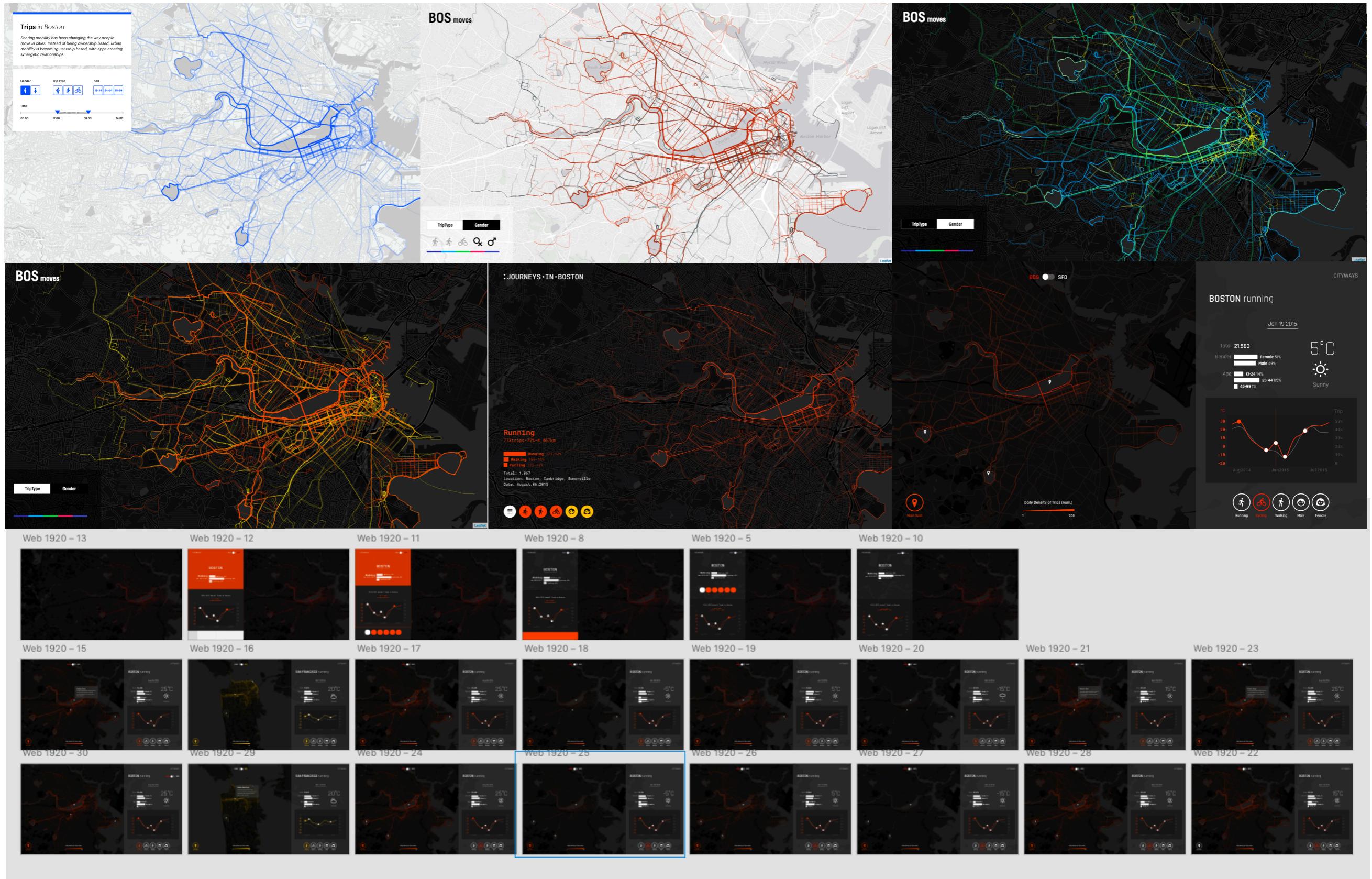
Source Sans Pro for body text

ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz1234567890!@#\$%^&()

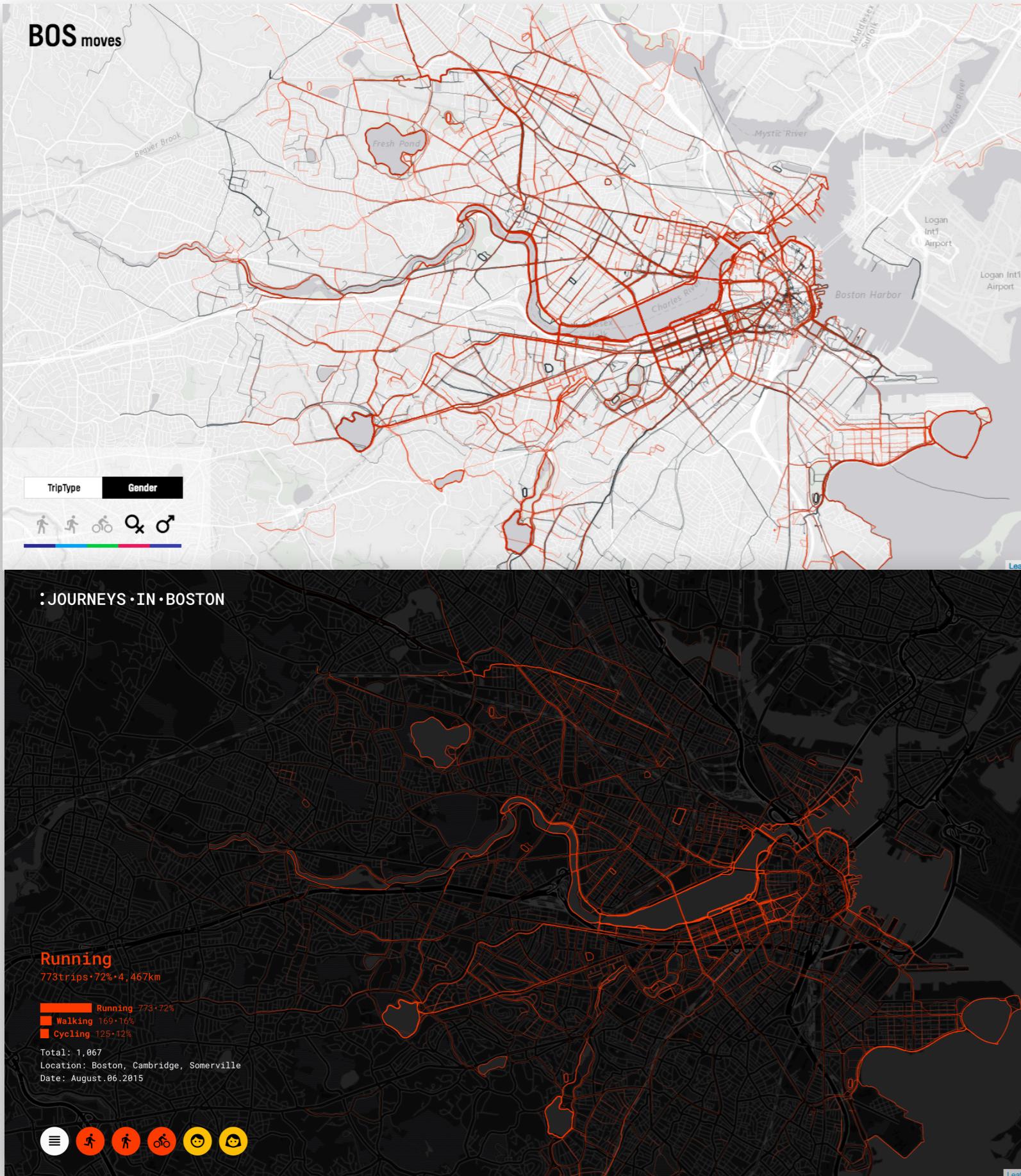
Slightly condensed
: Well designed typeface for user interface



CityWays > Design > Mockup (Application)



<https://projects.invisionapp.com/d/main#/console/10378188/220580859/preview>



High contrast between the colors of lines and base map

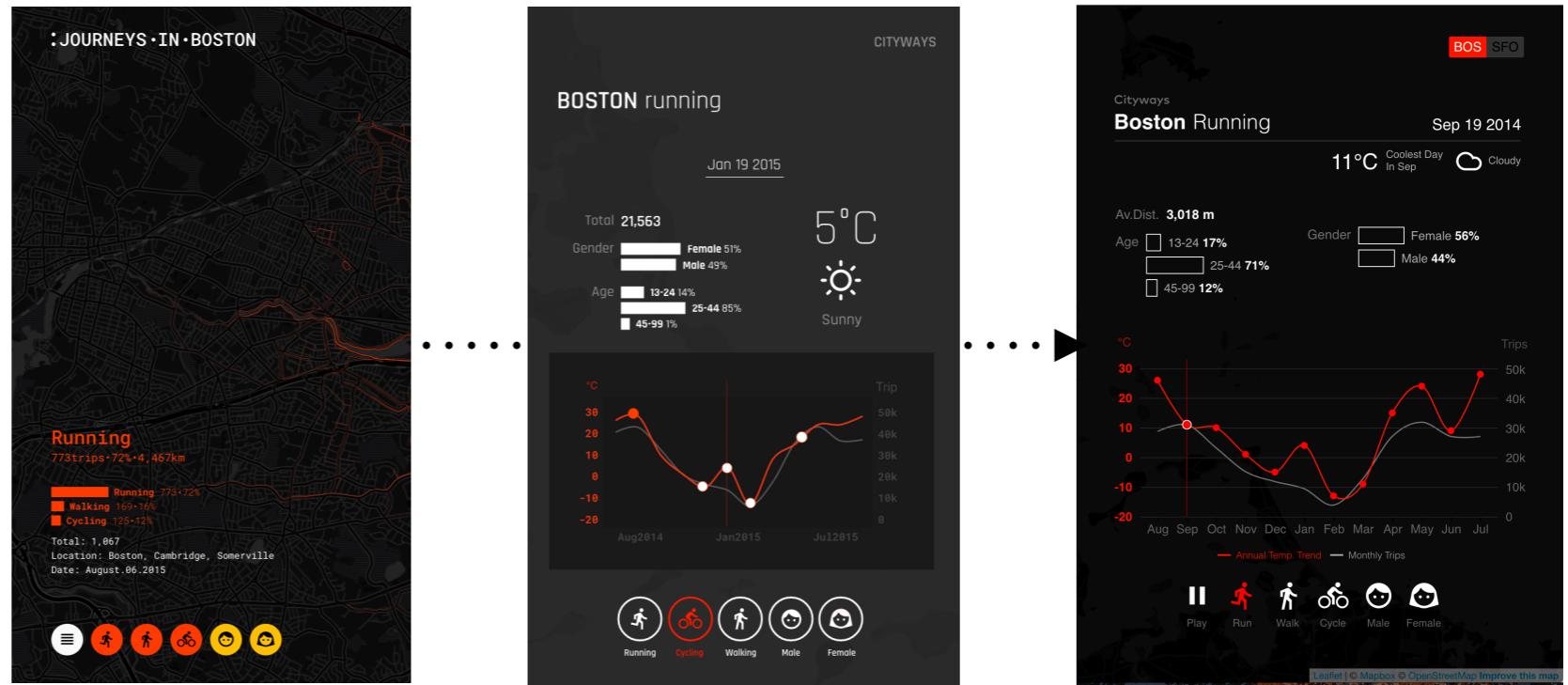
- : Most lines are vivid
- : Vague hierarchy among several group of trajectories

Bright base Maps are not good for visualization comprised of small objects or lines.

Red colored low density lines is naturally merged with black background are highlighted more vividly.

Feedback

"Information area is too small. If the area becomes larger than now, it would be better to understand information"



Feedback

"The slider will move but not through direct manipulation. I have to click the slider. This is not good interface design. If you show a slider, then people expect to be able to directly manipulate (drag) the slider. Otherwise it should just be a radio button if click is the desired action."



CityWays > Mockup (Landing Site)

This animation video automatically plays when the landing page is launched. The video loops continuously. No controllers.

A CITY IS SHAPED BY HUMAN MOVEMENT

Project Description

When a user does mouse over action on each map, the image shifts from the map to a graph

User interaction: Mouse Over

When a user does mouse over action on each map, the image shifts from the map to a graph

User interaction: Mouse Click

When a user does mouse click action on the app launch button, the application is opened on a new window.

Statistical information regarding a CITY (Boston, San Francisco) is illustrated with a simple bar graph

TEAM

Carla Reiss, Director
Anthony Vandy Research Lead

Paoletta Santi, Research Advisor
Fabio Santi, Project Manager
Ryoko Sano, Visualization
Bostonian Re Animation Video

PRESS

Download Project Material

The material on this website can be used freely in any publication provided that 1. it is cited as a project by the MIT Senseable City Lab 2. a PDF copy of the publication is sent to sensable-project@mit.edu

TEAM

Carla Reiss, Director
Anthony Vandy Research Lead

Paoletta Santi, Research Advisor
Fabio Santi, Project Manager
Ryoko Sano, Visualization
Bostonian Re Animation Video

PRESS

Download Project Material

The material on this website can be used freely in any publication provided that 1. it is cited as a project by the MIT Senseable City Lab 2. a PDF copy of the publication is sent to sensable-project@mit.edu

TEAM

Carla Reiss, Director
Anthony Vandy Research Lead

Paoletta Santi, Research Advisor
Fabio Santi, Project Manager
Ryoko Sano, Visualization
Bostonian Re Animation Video

PRESS

Download Project Material

The material on this website can be used freely in any publication provided that 1. it is cited as a project by the MIT Senseable City Lab 2. a PDF copy of the publication is sent to sensable-project@mit.edu

TEAM

Carla Reiss, Director
Anthony Vandy Research Lead

Paoletta Santi, Research Advisor
Fabio Santi, Project Manager
Ryoko Sano, Visualization
Bostonian Re Animation Video

PRESS

Download Project Material

The material on this website can be used freely in any publication provided that 1. it is cited as a project by the MIT Senseable City Lab 2. a PDF copy of the publication is sent to sensable-project@mit.edu

TEAM

Carla Reiss, Director
Anthony Vandy Research Lead

Paoletta Santi, Research Advisor
Fabio Santi, Project Manager
Ryoko Sano, Visualization
Bostonian Re Animation Video

PUBLICATION

L.I. Massimo, C. del P. Perez, A. Santi, R. S. Barakat, A. Lopresti, M. Rodriguez, A. Rodriguez, "The City in our Action: Sensing Human Movement in Cities," Proceedings of the ACM, vol. 10, n. 1, pp. 1-11, January 2017.

Press Release
SensableCityLab.org
Press Release
MIT Media Lab
Press Release
Bostonian Re Animation Video

CITIES ARE SHAPED BY HUMAN MOVEMENT

2004-2005 Annual Trend in Boston

2004-2005 Annual Trend in Boston

BOSTON running

25°C
Aug 20, 2014
Boston, MA, USA
Avg: 10.48 Miles
Gender: Male
Age: 26-35
Sun: Yes

BOSTON running

25°C
Aug 20, 2014
Boston, MA, USA
Avg: 10.48 Miles
Gender: Male
Age: 26-35
Sun: Yes

TEAM

Carla Reiss, Director
Anthony Vandy Research Lead

Paoletta Santi, Research Advisor
Fabio Santi, Project Manager
Ryoko Sano, Visualization
Bostonian Re Animation Video

PUBLICATION

L.I. Massimo, C. del P. Perez, A. Santi, R. S. Barakat, A. Lopresti, M. Rodriguez, A. Rodriguez, "The City in our Action: Sensing Human Movement in Cities," Proceedings of the ACM, vol. 10, n. 1, pp. 1-11, January 2017.

Press Release
SensableCityLab.org
Press Release
MIT Media Lab
Press Release
Bostonian Re Animation Video

CITIES ARE SHAPED BY HUMAN MOVEMENT

2004-2005 Annual Trend in Boston

2004-2005 Annual Trend in Boston

BOSTON running

25°C
Aug 20, 2014
Boston, MA, USA
Avg: 10.48 Miles
Gender: Male
Age: 26-35
Sun: Yes

BOSTON running

25°C
Aug 20, 2014
Boston, MA, USA
Avg: 10.48 Miles
Gender: Male
Age: 26-35
Sun: Yes

TEAM

Carla Reiss, Director
Anthony Vandy Research Lead

Paoletta Santi, Research Advisor
Fabio Santi, Project Manager
Ryoko Sano, Visualization
Bostonian Re Animation Video

PUBLICATION

L.I. Massimo, C. del P. Perez, A. Santi, R. S. Barakat, A. Lopresti, M. Rodriguez, A. Rodriguez, "The City in our Action: Sensing Human Movement in Cities," Proceedings of the ACM, vol. 10, n. 1, pp. 1-11, January 2017.

Press Release
SensableCityLab.org
Press Release
MIT Media Lab
Press Release
Bostonian Re Animation Video