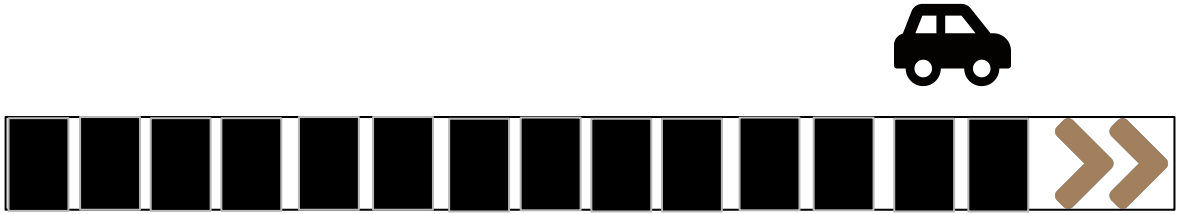
# Incorporating Public Transit into Measures of Accessibility



**UBCO 2021 Capstone Project**

# Overall progress

**Week 7**



# Week 7

## Overall Progress and Completed Tasks

# Last Week's Tasks

## Week 6

- Developing final report (Introduction, background, methodology)
- Creating network efficiency maps
- Comparison between days and types in Kepler.gl
- Overlaying bus stop information on maps
- Other (more code merging, file cleaning, and wrangling functions)

# Preliminary Results

- **Drafted introduction, background, and methodology sections**

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- **Developed Kepler visualizations with comparisons in dual views**

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- Drafted introduction, background, and methodology sections
- Developed Kepler visualizations with comparison in dual views
- **Created a brand new way to measure and visualize transit network efficiency regarding access to cultural amenities.**

# Preliminary Results

- How does transit access compare to transit needs across Greater Vancouver?
  (ie. *How optimized is the transit network for cultural amenities?*)

- Efficiency is how well **resources** for accessibility,
  match the **needs** for accessibility.

# Preliminary Results

**Efficiency is how well resources for accessibility, match the needs for accessibility.**

| **I have 10 apples.** | Their Needs | An inefficient distribution | An efficient distribution |
|---|---|---|---|
| Rain | 0 | | |
| Yuxuan | 3 | | |
| Graham | 9 | | |
| | usually...<br>Needs > Resources | | |

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| **I have 10 apples.** | Their Needs | An inefficient distribution | An efficient distribution |
|---|---|---|---|
| Rain | 0 | 3 | |
| Yuxuan | 3 | 3 | |
| Graham | 9 | 4 | |
| | usually...<br>Needs > Resources | \|0-3\|+\|3-3\|+\|9-4\| = **8** | |

# Preliminary Results

**Efficiency is how well resources for accessibility, match the needs for accessibility.**

| **I have 10 apples.** | Their Needs | An inefficient distribution | An efficient distribution |
|---|---|---|---|
| Rain | 0 | 3 | 0 |
| Yuxuan | 3 | 3 | 2 |
| Graham | 9 | 4 | 8 |
| | usually...<br>Needs > Resources | \|0-3\|+\|3-3\|+\|9-4\| = **8** | \|0-0\|+\|3-2\|+\|9-8\| = **2** |

# Preliminary Results

**Efficiency is how well resources for accessibility, match the needs for accessibility.**

*Individual block efficiency*

| **I have 10 apples.** | Their Needs | An inefficient distribution | An efficient distribution |
|---|---|---|---|
| Rain | 0 | 3 | 0 |
| Yuxuan | 3 | 3 | 2 |
| Graham | 9 | 4 | 8 |
| | usually...<br>Needs > Resources | \|0-3\|+\|3-3\|+\|9-4\| = **8** | \|0-0\|+\|3-2\|+\|9-8\| = **2** |

*Aggregated efficiency*

# Preliminary Results

**Eff1** = **abs(Amenity Access via Transit** - **Transit Network Needs)**

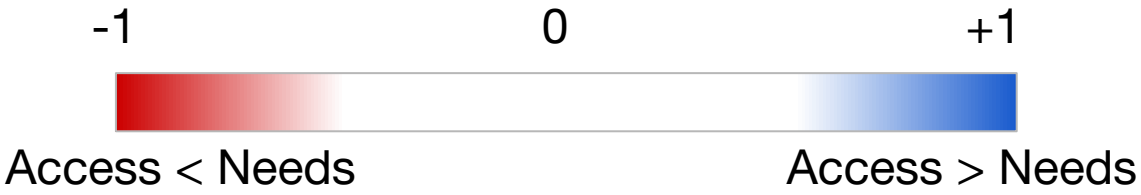
**Eff2** = **(Amenity Access via Transit** - **Transit Network Needs)^2**

- Depending on what you are looking for:
  - **Eff1** = provides comparable difference between blocks
  - **Eff2** = highlights the extremely deviatiating blocks

# Preliminary Results

**Eff** = **norm**$_{[-1, 1]}$ **(Amenity Access via Transit** - **Transit Network Needs)**

This way we can visualize areas on both ends of the error spectrum:



# Preliminary Results

- **Cultural Amenity Transit Accessibility**
  - The scores we've talked about over the last 3-4 weeks

- **Transit Network Needs**
  - = $w_1$ (Block Population * %Transit Dependent) → where people come from
    + $w_2$ (Traffic Intensity) → roads people use
    + $w_3$ (Amenity Density) → where people need to go

# Preliminary Results

- **Cultural Amenity Transit Accessibility**
  - The scores we've talked about over the last 3-4 weeks

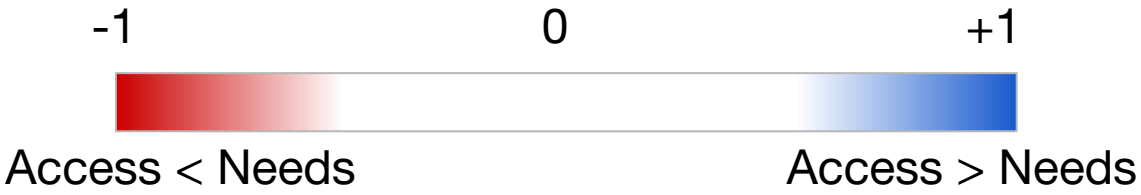
- **Transit Network Needs**
  - = $w_1$ (Block Population)
    + $w_2$ (Traffic Intensity)
    + $w_3$ (Amenity Density)

%Transit Dependent not yet predictable/available

# Preliminary Results

**Eff = norm$_{[-1, 1]}$ (%ile Access Score - %ile Network Needs)**

This way we can make distributions comparable:



# Vancouver GTFS Data

- Vancouver GTFS data
  - Agency.txt
  - Directions.txt
  - Shapes.txt
  - Transfer.txt
  - Trips.txt
  - Stops.txt
  - Stop_times.txt
  - ...

# Data For Bus Stops

- Vancouver GTFS data
  - Agency.txt
  - Directions.txt
  - Shapes.txt
  - Transfer.txt
  - Trips.txt
  - Stops.txt
  - Stop_times.txt
  - ...

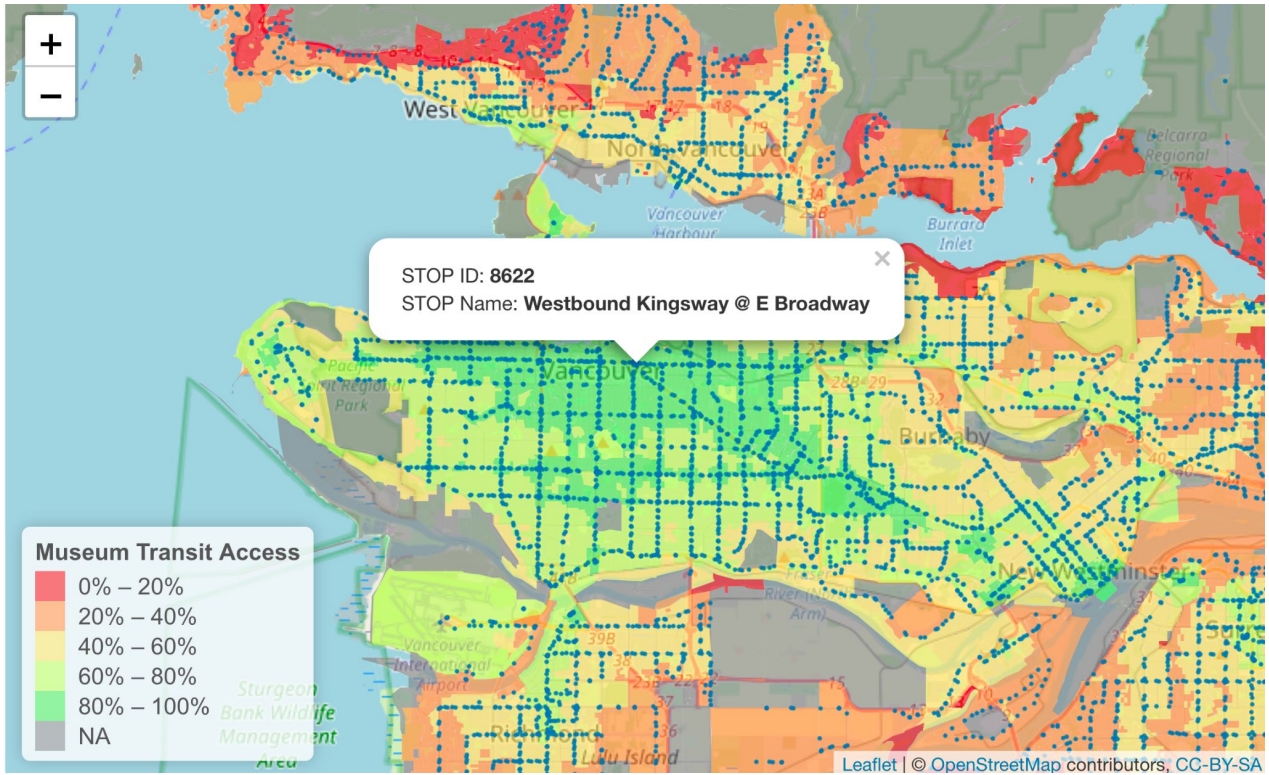
# Data For Bus Stops

Description: df[,10] [6 × 10]

| | stop_id <int> | stop_code <int> | stop_name <chr> | latitude <dbl> | longitude <dbl> |
|---|---|---|---|---|---|
| 1 | 1 | 50001 | Westbound Davie St @ Bidwell St | 49.28645 | -123.1404 |
| 2 | 11 | 50011 | Eastbound Davie St @ Howe St | 49.27755 | -123.1270 |
| 3 | 14 | 50014 | Eastbound Pacific Blvd @ Homer St | 49.27292 | -123.1255 |
| 4 | 21 | 50021 | Eastbound E Pender St @ Carrall St | 49.28039 | -123.1038 |
| 5 | 22 | 50022 | Northbound Columbia St @ E Pender St | 49.28077 | -123.1022 |
| 6 | 25 | 50025 | Westbound Davie St @ Granville St | 49.27743 | -123.1265 |

# MAP+ addCircles() -> Shows bus stops

# Added Bus Stops On a Map



# Quick Demo!

# Accomplishments

- **Comparisons on Kepler.gl maps**

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  - Weekdays v.s. Weekends

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  - Isochrones v.s. Locations of amenities

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- **Comparisons on Kepler.gl maps**

  - Weekdays v.s. Weekends
  - Isochrones v.s. Locations of amenities
  - Between different types

# Accomplishments

**A Quick Demo**

**Comparison between Weekday and Saturday**

# Roadblocks

**Kepler.gl maps**

1. Lagging due to large scale of data

# Roadblocks

**Kepler.gl maps**

1. Lagging due to large scale of data
    - Remove population data
    - Split the overall map into 4 maps by types

# Roadblocks

**Kepler.gl maps**

1. Lagging due to large scale of data
    - Remove population data
    - Split the overall map into 4 maps by types

2. Overlaying locations of amenities rendered maps too busy
    - Having one type of amenities selected each time

# Roadblocks

3. Difficulty publishing the dashboard

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    - File **size limit** using r.cloud

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    - File **number limit** using r.cloud

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    - File **size limit** using r.cloud
    - File **number limit** using r.cloud
    - Try: heroku and Shiny Server (open source)

# Roadblocks

4. We were so distracted with the dashboard, efficiency modeling, kepler, and code preparation that **we forgot to analyze the data we computed for Vancouver**.

   This is **not something the client is looking for**; however, we strongly believe it will enrich the report and final proof of concept.
   - To do this week

# Week 7 Plan

- **Statistical analyses on transit accessibility:**
  - Overall City summary
  - By different times/days
  - By different areas
  - Aggregated network “efficiency”

- **Deeper questions surrounding the data:**
  - Does transit access to cultural amenities correlate with average neighbourhood rental prices?

# Week 7 Plan

- **Completion of the final report**
  - Results
    - Method Visualizations/Dashboard
    - Vancouver Case Study
  - Discussions
    - Method Visualizations/Dashboard
    - Vancouver Case Study Analysis
    - Reasoning behind certain methods
  - Limitations / Assumptions
  - Future Research

- **Finalize and deploy the dashboard with Kepler.gl maps**

# Week 6 - Timeline

| Weekly Tasks<br>*This week's theme:*<br>**Dashboards and Scoring Models** | Mon.<br>6/7/2021 | Tue.<br>6/8/2021 | Wed.<br>6/9/2021 | Thu.<br>6/10/2021 | Fri.<br>6/11/2021 | Sat.<br>6/12/2021 |
|---|---|---|---|---|---|---|
| Publish dashboard | All ☐ | | | | | |
| Create weekly presentation | All ☑ | | | | | |
| Report writing - Intro | Luka ☑ | Luka ☑ | Luka ☑ | Luka ☑ | | |
| Report writing - Background & Methodologies (UrbanAccess and Kepler.gl) | Rain ☑ | Rain ☑ | Rain ☑ | Rain ☑ | Rain ☑ | |
| Report writing - Methodologies - Weight Index | Yuxuan ☑ | Yuxuan ☑ | Yuxuan ☑ | Yuxuan ☑ | Yuxuan ☑ | |
| Report writing - Methodologies - Dashboard | Graham ☑ | Graham ☑ | Graham ☑ | Graham ☑ | Graham ☑ | |
| Report writing - Methodologies - Scores Sets & Computation | Luka ☑ | Luka ☑ | Luka ☑ | Luka ☑ | Luka ☑ | |
| Dashboard astectics | Graham ☑ | | | | | |
| Incorporate weekday and weekend maps into one Kepler.gl map | | Rain ☑ | Rain ☑ | | | |

# Week 7 - Timeline

| Weekly Tasks<br>*This week's theme:*<br>**Dashboards and Scoring Models** | Mon.<br>6/14/2021 | Tue.<br>6/15/2021 | Wed.<br>6/16/2021 | Thu.<br>6/17/2021 | Fri.<br>6/18/2021 | Sat.<br>6/19/2021 |
|---|---|---|---|---|---|---|
| Report writing - Results | All ☑ | All ☐ | All ☐ | All ☐ | | |
| Report writing - Discussions | All ☑ | All ☐ | All ☐ | All ☐ | All ☐ | |
| Report writing - Limitations & Future research | | | All ☐ | All ☐ | All ☐ | |
| Statistical analyses - by time windows | | Rain ☐ | Rain ☐ | | | |
| Statistical analyses - by areas / renting prices | | Yuxuan ☐ | Yuxuan ☐ | | | |
| Statistical analyses - Descriptive summary | | Luka ☐ | Luka ☐ | | | |
| Statistical analyses - Efficiency summary stats | | Luka ☐ | Luka ☐ | | | |
| Fix any Minor Issues and Deploy dashboard | | All ☐ | All ☐ | All ☐ | All ☐ | |
| Code Review and Documentation | | | | Luka ☐ | Luka ☐ | |
| Executive Report | All ☑ | All ☐ | All ☐ | All ☐ | All ☐ | |
| Create weekly presentation | All ☑ | | | | | |

# Closing Remarks

It’s going to be a busy week.