



# **BIXI Project EDA-Part 2 Business Report**

**By Lucia Zhang**

## **Project Summary**

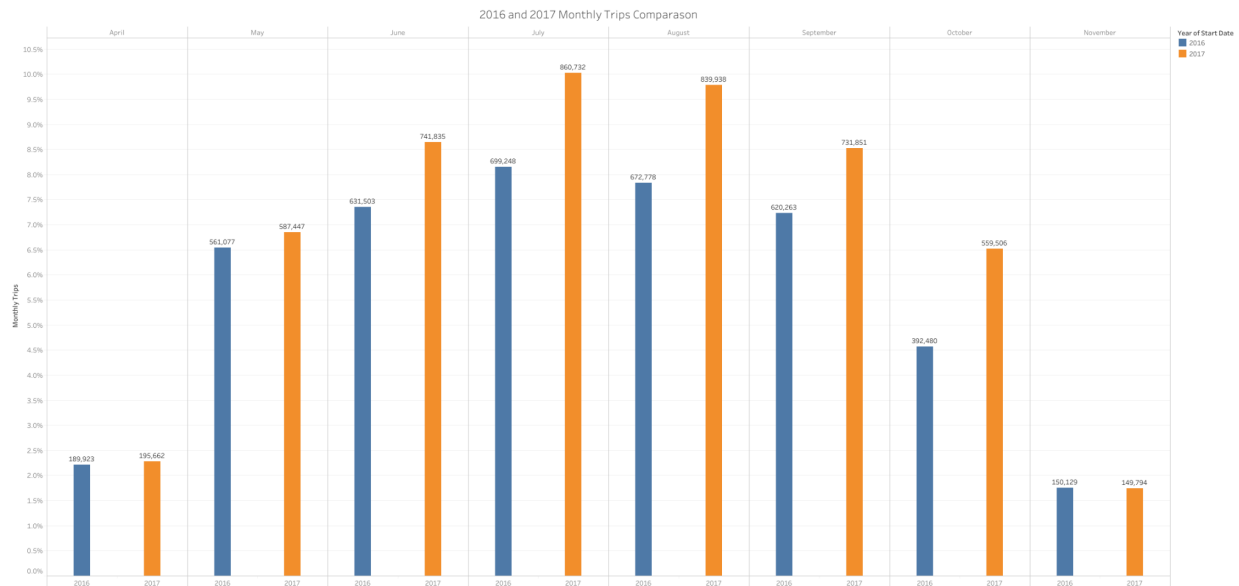
As a rapidly growing bike-sharing service, BIXI was founded by the city of Montreal in 2014, aiming to provide locals and tourists with a quick and convenient transportation alternative while promoting green environment concepts. To remain successful, BIXI needs to maximize revenues and optimize the operating systems.

Facing the rapidly growing popularity of bike-sharing systems worldwide, this study explores the trip characteristics of using public bikes at the level of zonal Origin-Destination (O-D) pairs, particularly with respect to the effect of pricing scheme change.

- The first step: EDA data analysis to gain overall views in terms of: business annual performance, any new trend different from last year.
- The 2nd step: zoom in, closely examine data for any patterns and insights learning about how people use the Bixi service, any correlation between round trips, membership and trip durations.
- While the revenue generated from members are steady and solid, Bixi needs the insights of price sensitivity and effectiveness to infrequent users, and tries to find a way to push the revenue to the next level.
- Findings are followed by insights and recommendations
- The purpose and goal is to gain a high-level understanding, find a dynamic model and optimized solutions in pricing, marketing, logistics/operations to maximize overall business growth.

To gain an overall view of business in general and specific areas, we explored and analyzed data from 2016 and 2017.

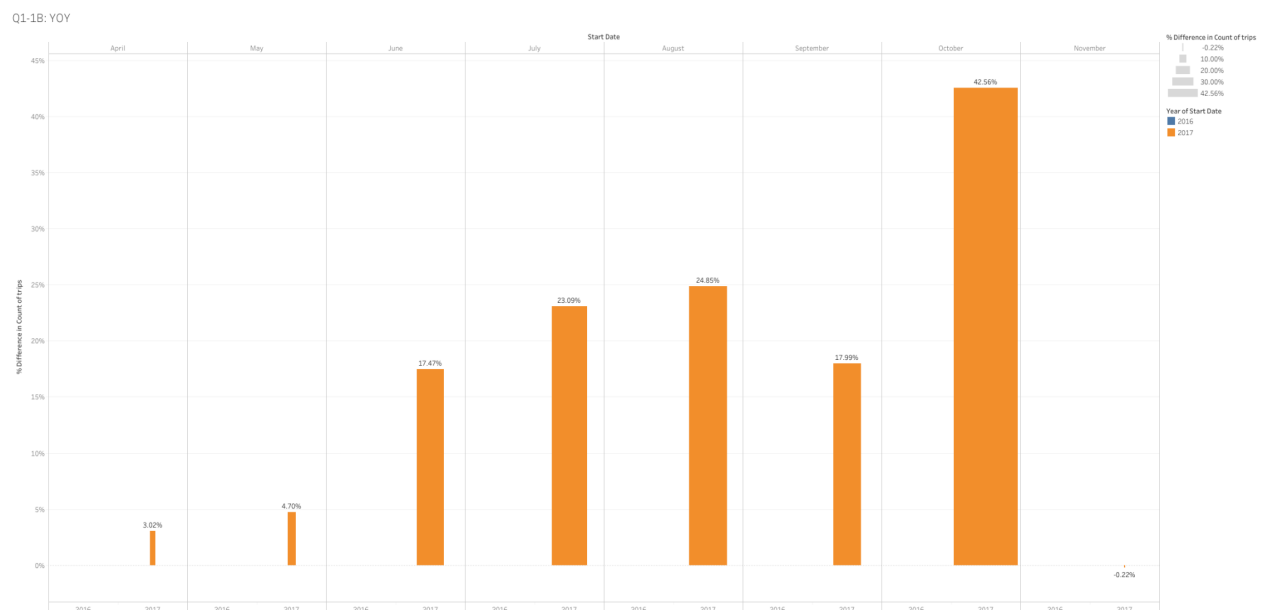
## Findings - Part 1 : Membership,Rider Patterns, Social and Seasonal Factors



For full view, pls click link: [2016 and 2017 Monthly Trips Comparison | Tableau Public](#)

- As part of continued effort to improve business performance, in 2017 the total yearly trip counts hit 4,666,765, increased by 19.13%; the monthly trips during peak season in July and Aug were over 23% higher than 2016, Oct hit a record high increase: 42.56%, though Nov slightly decreased by 0.22%.

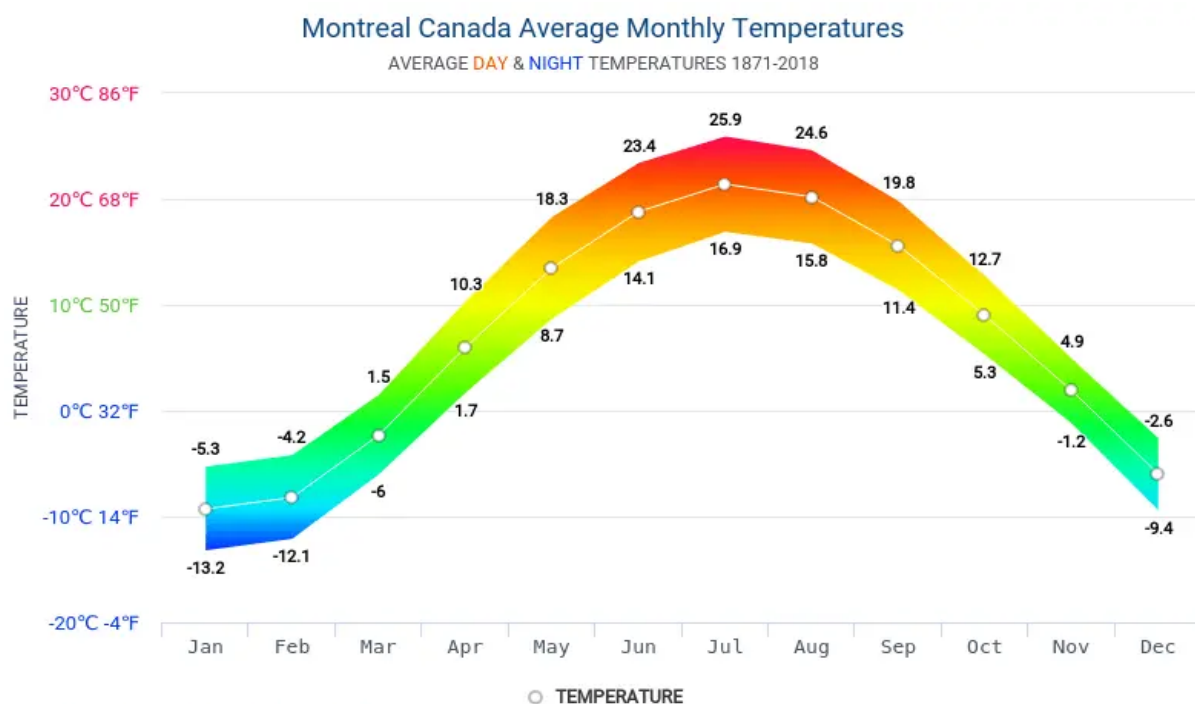
### [2016 and 2017 Monthly Trips Comparison: YOY | Tableau Public](#)



For full view, pls click link: [2016 and 2017 Monthly Trips Comparison: YOY | Tableau Public](#)

**Data interpretation:** The pattern reflects a combination of seasonal and social factors: weather, tourists, school schedule, city events and festival activities.

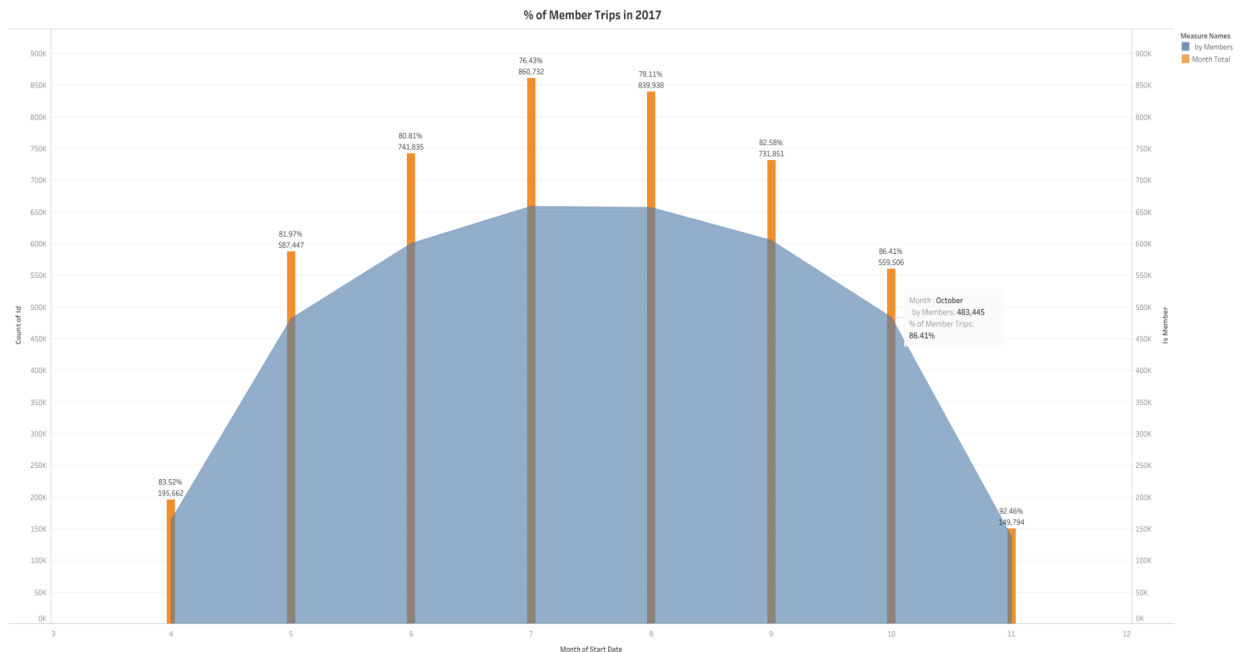
- Montreal is a city known for its high range of temperatures, it can easily get as hot as 30 °C in the summer and as low as -30 °C in the winter.  
The bikes from BIXI are taken off the streets in November and brought back in April. Due to extreme weather conditions, Jan, Feb and Dec 3 months see zero trips, Apr. is a starting month and Nov as an ending season.
- Peak travel to Montreal occurs between June and September, especially during July and August, the months when most North American schools are out. July and August are also when Old Montreal is bustling and the city's festival schedule is in full swing. Summer weather in Montreal is warm and sunny and perfect for strolling the streets, and tens of thousands of people descend on Montreal to shake their stuff for these festivals and others. If you visit Montreal between June and September, you will have no shortage of open-air activities, public programming, and neighborhood festivities—both big and small scale—to spice up your Montreal stay. [Data source: https://www.tripsavvy.com/pictures-and-recommendations-for-old-montreal-1481909](https://www.tripsavvy.com/pictures-and-recommendations-for-old-montreal-1481909)



[hikersbay.com/climate/canada/montreal](https://hikersbay.com/climate/canada/montreal)

- Autumn, from September to mid-November, is initially pleasant, in fact, with several sunny days, with temperatures exceeding 25 °C (77 °F): this kind of weather, called Indian summer, usually occurs in September, but sometimes also in the first half of October. As the weeks pass, however, the temperature decreases rapidly, bad weather becomes more frequent, and the first cold days occur.

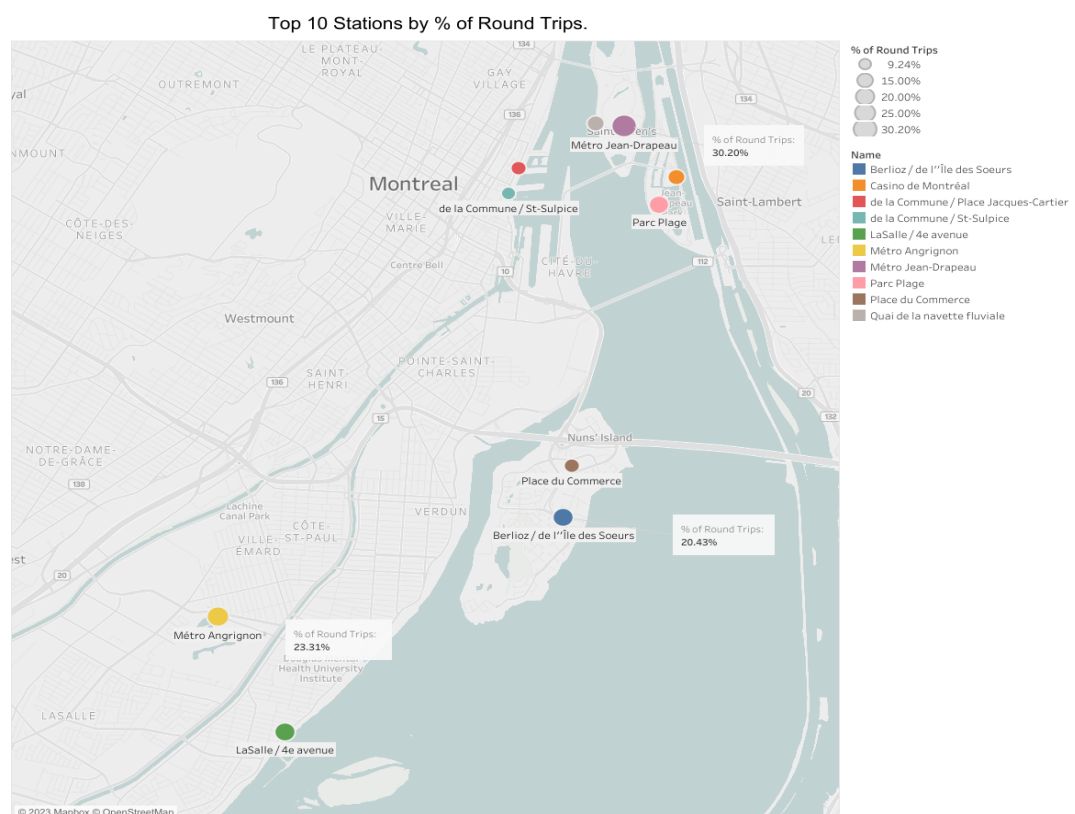
- In 2017 the members contributed 81.10% of total trips, the monthly breakdown as below: Please click the link for full view: [Percentage of Member Trips in 2017 | Tableau Public](#)



Based on data, there is a normal distribution pattern: Apr and Nov have extremely low numbers, each at the left and right tail, July and August sit at the peak of the curve.

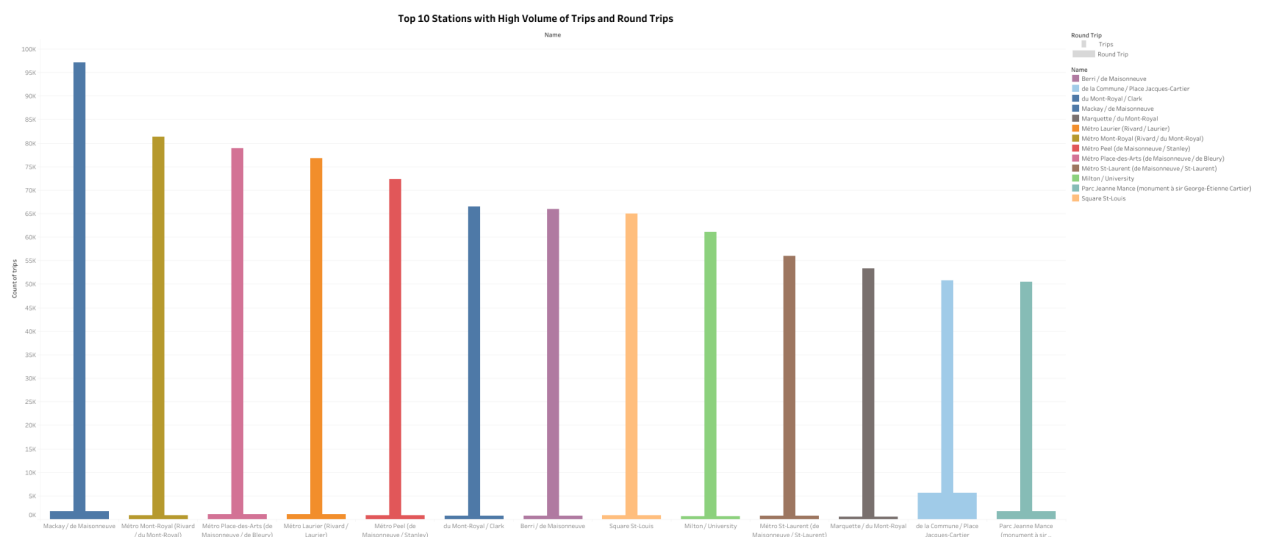
- Top 10 stations with the highest percentage of round trips as below, easily spot them where:

### [Top 10 Stations | Tableau Public](#)



- Locals and tourists can enjoy diverse cultural and sports programming: [Métro Jean-Drapeau](#),
  - Parks, beaches, resorts, sightseeing spots, the perfect place for family, couples and friends getaways: [Parc Plage](#)
  - subway or bus stations where bikers can easily connect to next trips: [Métro Angrignon](#)
  - Residential areas: [Lasalle / 4e Avenue](#)
- Since the original start station (O) and destination end station (D) are not equally paired with even trips, we further examined the stations in terms of high volume of trips and round trips. It is wise to keep the following stations on the priority watch list: from left to right, the single trips number decreases while the number of round trips does not.

#### [Top 10 Stations with High Volume of Trips and Round Trips | Tableau Public](#)



For full view, please click the link: [Stations with High Volume of Trips and Round Trips | Tableau Public](#)

### Conclusion and insights:

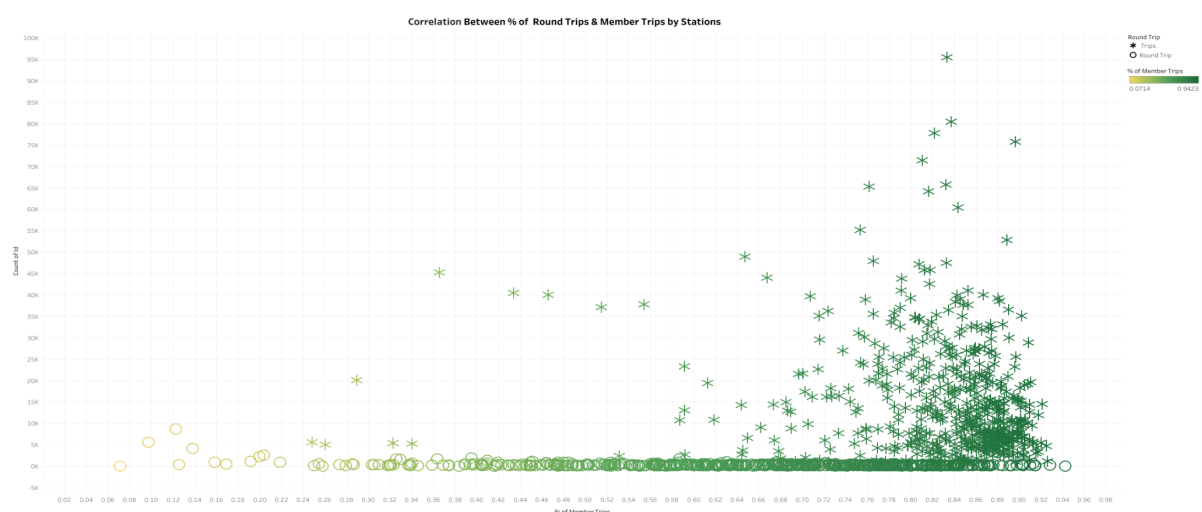
- It indicates synthetic demand patterns and a combination of seasonal and social factors such as weather, tourists, school schedule, city events and festival activities are
- and seasonal weather is the biggest uncontrollable factor in the biking business: warmer the better. The demand for Bixi bikes is at its peak in July and Aug.
- It's fair to conclude that membership is the major driving force to the increase of trip numbers, especially during Apr, May, Oct to Nov, the percentage as high as 82% to 92%.
- The ratio of trips by members slightly decreased from 84% in Apr to 76% by July, then slowly increased to 78% in Aug and all the way to 93% by Nov.
- The pattern of trips by non-members: vice versa, they contribute most of the trips during the tourist peak season in Montreal which occurs between June and September, especially during July and August, the months when most North American schools are out. July and August are also when Old Montreal is bustling and the city's festival schedule is in full swing.

## Recommendations:

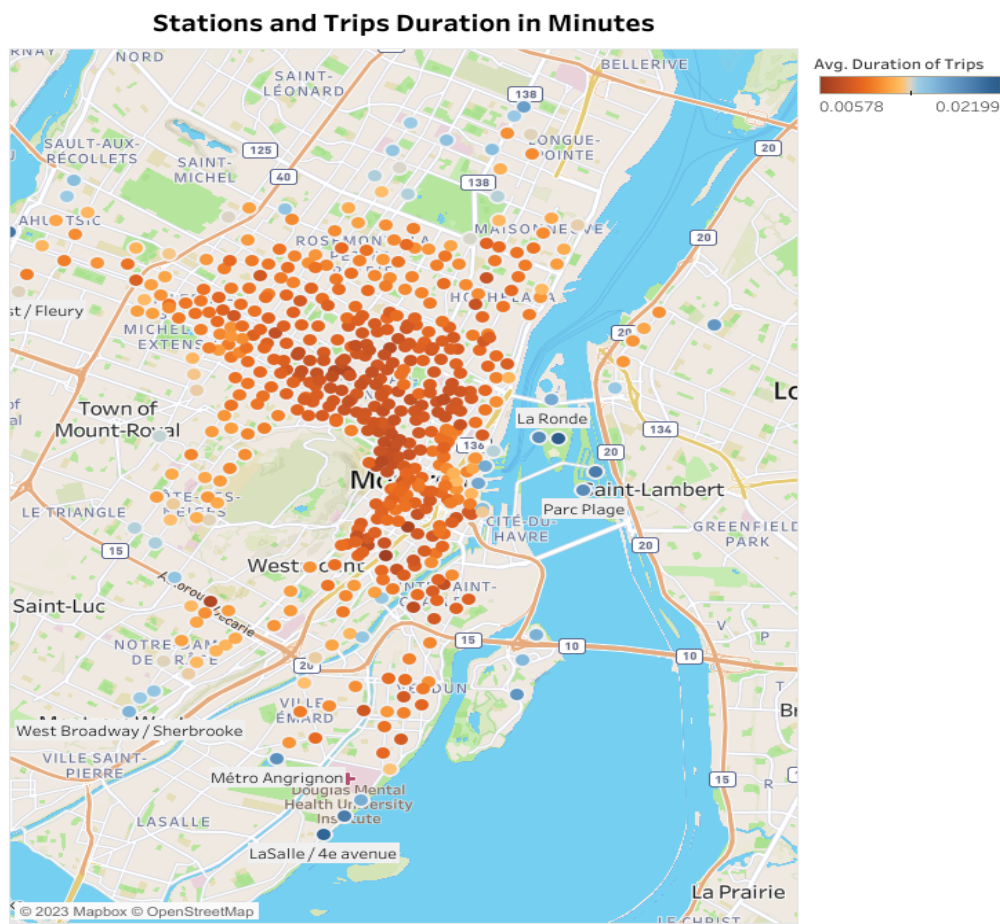
- Please take these patterns and insights into consideration when deciding the timing to launch marketing campaigns to target different biker groups at different times of the year.
- Round trips ratio varies station by station. Based on data, the operation and logistics process should mirror the hoc data, to be agilely monitored, adjusted and maintained to keep up with the demand, supply and level of service.
- If offering non-members a special promotion in an attempt to convert them to members, the company may consider advertising and a promotion campaign in early April as a good kicking start; once converted, these new members can contribute to business growth all the way till the end of season which is Nov.
- Bixi has been very creative with effective pricing packages to promote membership, such as seasonal/monthly membership, one-way passes and group rates. BIXI Corporate Program targets companies to promote an active lifestyle. While the member and non-member behavior patterns suggest family package, friend referrals, rewarding bonus, gift cards, etc. can be other attractive offerings: who can refuse the invitation to take a fun ride with family members and friends on a good sunny day?
- Montreal is famous for rich historical Architectures, Bixi may also consider working with the tourist industry and issuing bike ride cards and gift cards with print of Montreal's Top 10 Architectural Marvels, local sightseeings and touch of art. This could be a good catch to both local residents and tourists.
- Customer satisfaction is critical to all business success. With so many stations stretching across Montreal, while the original start station (O) and destination end station (D) are not equally paired with even trips, it is wise to keep these stations on priority watch list for the purpose of station/bike maintenance, logistics planning and controlling.

## Findings -part 2 : Stations, Traffic Patterns and Member Trips

### [Correlation BTW Round Trips, Member Trips by Stations | Tableau Public](#)



- As per data and plot above, there is a strong correlation between the percentage of round trips and member trips at most stations. As per data, members contributed over 80% of annual trips. It's easy to understand that major members are regular users year round, they come back and forth between origin station (O) to end station (D) for work or daily chores. While for other stations located in tourist or leisure zones, bikers may just go from station A and drop off bikes right at station B once done with the sightseeings.
- Among the O-D pairs with start\_date and end\_date, it is found the duration of trips in minutes varies: average member trips in minutes (mm:ss) 12:12 while average non-member trips: 20:22. During peak season when lots of tourists, students and non-member residents are taking time to ride bikes for fun, they tend to spend longer time to ride along, which can reveal why this pattern exists.
- The average trip duration per station across the city is in minutes (mm:ss) between 8:19 ~ 31:40. There is an obvious pattern: the shortest duration trips are concentrated in the center area and surrounded by longer and longer duration ones. When zoomed in the map, it shows that the shortest trips are found at locations of dense population such as universities, stadium, museum, public transit stations etc.; longer trips vice versa, in suburban areas, the further away from the population dense areas (longer distance to commute), the longer the trip takes.



Please click the link for full view : [Stations and Trip Duration in Minutes | Tableau Public](#)



## Conclusion and insights:

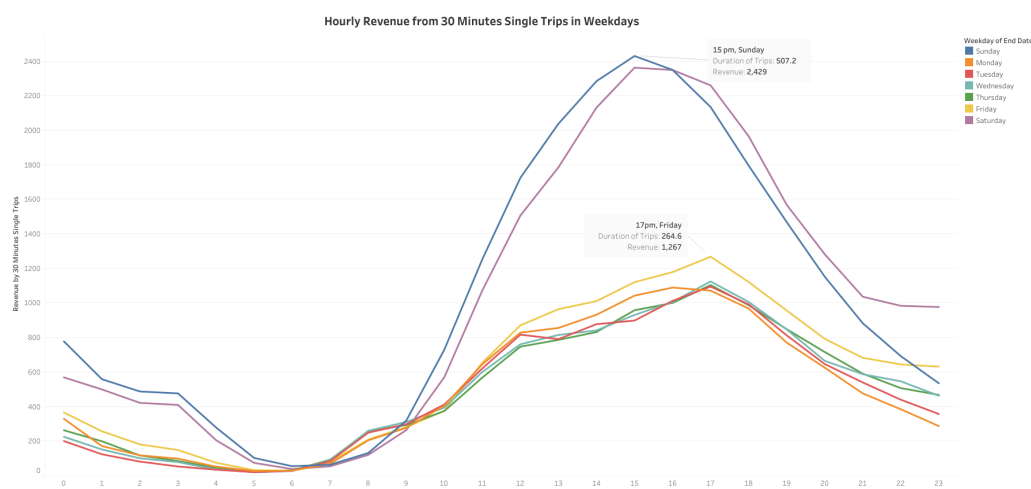
- Bike sharing is increasing in popularity as a mobility solution for Montrealers and residents of the metropolitan area, the network is denser in the city center, BIXI saw an increase in both ridership and the number of members
- It indicates members are the rock foundation of BiXi bike sharing business, they contribute the majority of the trips and round trips on a regular basis, but the average duration 12:12 is shorter than non-members' 20:22, due to the nature of different usage, seasonal and social elements, tourists and non-members tend to have more single trips.
- Short trips are concentrated in population dense areas, surrounded by longer and longer trips spreading farther away from the city.

## Recommendations:

- Since non-members contribute to longer trips, it's recommended to promote attractive riding pricing models, bundles with phone or internet packages, build business alliances with tourist industry, airport, cruise ships, taxi companies, schools, universities and local communities.
- To reward the loyal members, offer them a bonus when they introduce their friends and family to bike rides and develop new memberships.
- For operation and logistics teams, they may monitor the pattern between bike maintenance, distance and duration of trips.

## Findings - Part 3 : Pricing Model and Revenue Exploration

- While the revenue Bixi generates from their members, and 1-day and 3-days passes is fairly well understood by the business. To get a better understanding of the revenue generated by infrequent users who make single, shorter trips an hour long or less, we tested the pricing model and revenue based on 30 Minutes, 45 Minutes and 60 Minutes groups assuming every non-member trip is a single trip. The total:



[Hourly Revenue from 30 Minutes Single Trips in Weekdays | Tableau Public](#)

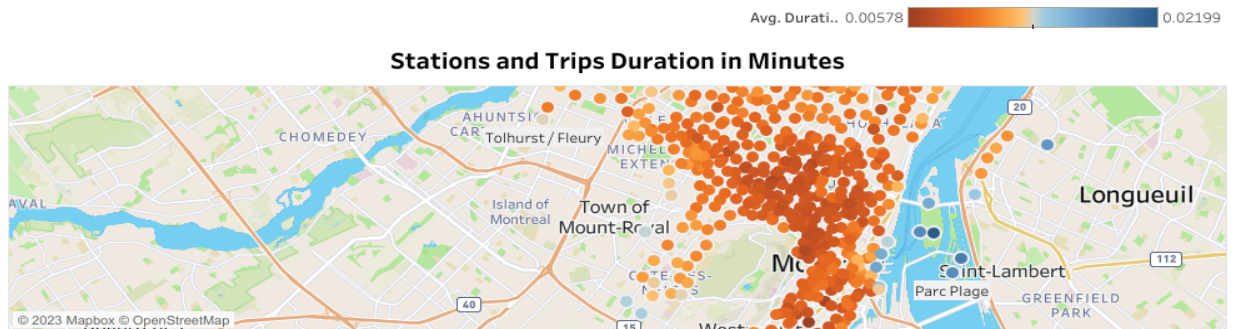


- To further search the patterns and insights, we examined the hourly data for 30-minute short trips: during morning, before 10 am, the total revenue in hundred, after 11am the number doubles, single trips increase dramatically then hit the peak hour 17pm time to go home for dinner, from 20pm, the total revenue drops dramatically, riding number dying down and hit the lowest level at 6am in the morning.
- During weekdays: the peak hour appears at 17 pm in the afternoon, and on Fridays, 30-minute single trips generate the most hourly revenue at that time.
- During weekends: peak hour is at 15 pm on both Saturdays and Sundays. This pattern and trend reflects the main character and nature of single trip bike riding: leisure, for fun, tell us how and when the single trip riders commute.

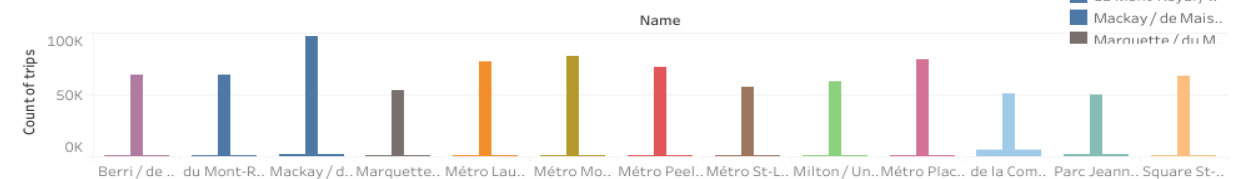
## Conclusion and Recommendations:

- Overall the BiXi is running very well in every aspect of business.
- To strive for continuing success, the company needs to make data driven decisions, monitor, control and adjust the strategies moving along with the seasonal factors and various patterns.
- Based on the pattern of single trips, the marketing team could work out another pricing model for A/B Testing before officially rolling out.
- For an optimized operation process, the team could plan and organize the daily workload, maintenance, and resources based on these patterns.

### Station Map with Trip Durations & Volume Patterns



### Top 10 Stations with High Volume of Trips and Round Trips



### Hourly Revenue from 30 Minutes Single Trips in Weekdays

