Visual Analysis into Bixi

Introduction

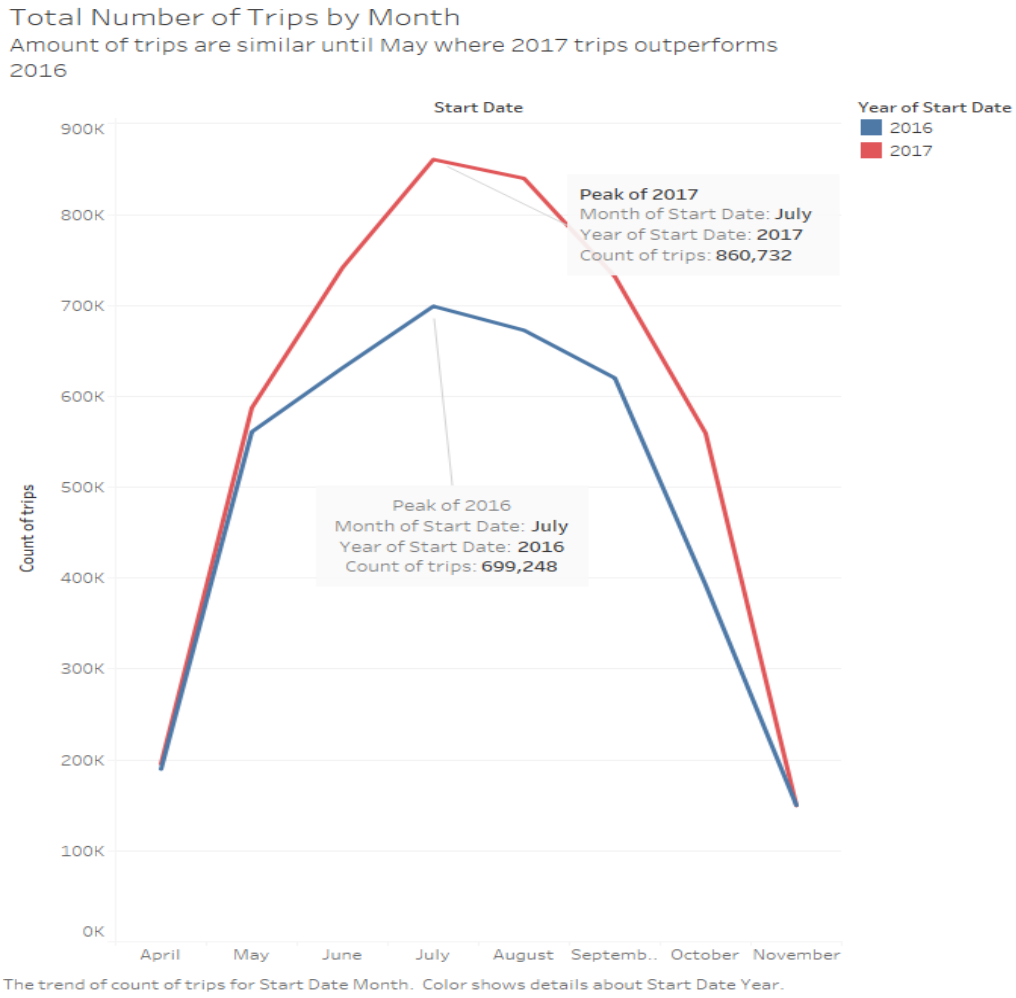
Bixi is a bike-sharing system where people can grab a bike from one of their stations and pay per minute of riding after returning the bike to a station. Bixi also has a membership system where it provides members with 45-minutes free rides. The purpose of this report is to provide answers to various questions from individuals from multiple fields within the Bixi organization. This will be done by giving a general insight of Bixi's growth, how people are using Bixi and factors that affect usage, and some insight into a proposed new pricing model.

Methodology

The data that'll be analyzed and visualized will be the data from 2016 and 2017 of each trip. The data provided includes each individual trip information such as the starting and ending station and time of a trip including the date, as well as if the person was a member or not. Since the purpose of this report isn't to look at a specific trip or use case, the data will be aggregated into a consensus to get a better understanding of Bixi in general which will help draw conclusions to the questions presented above.

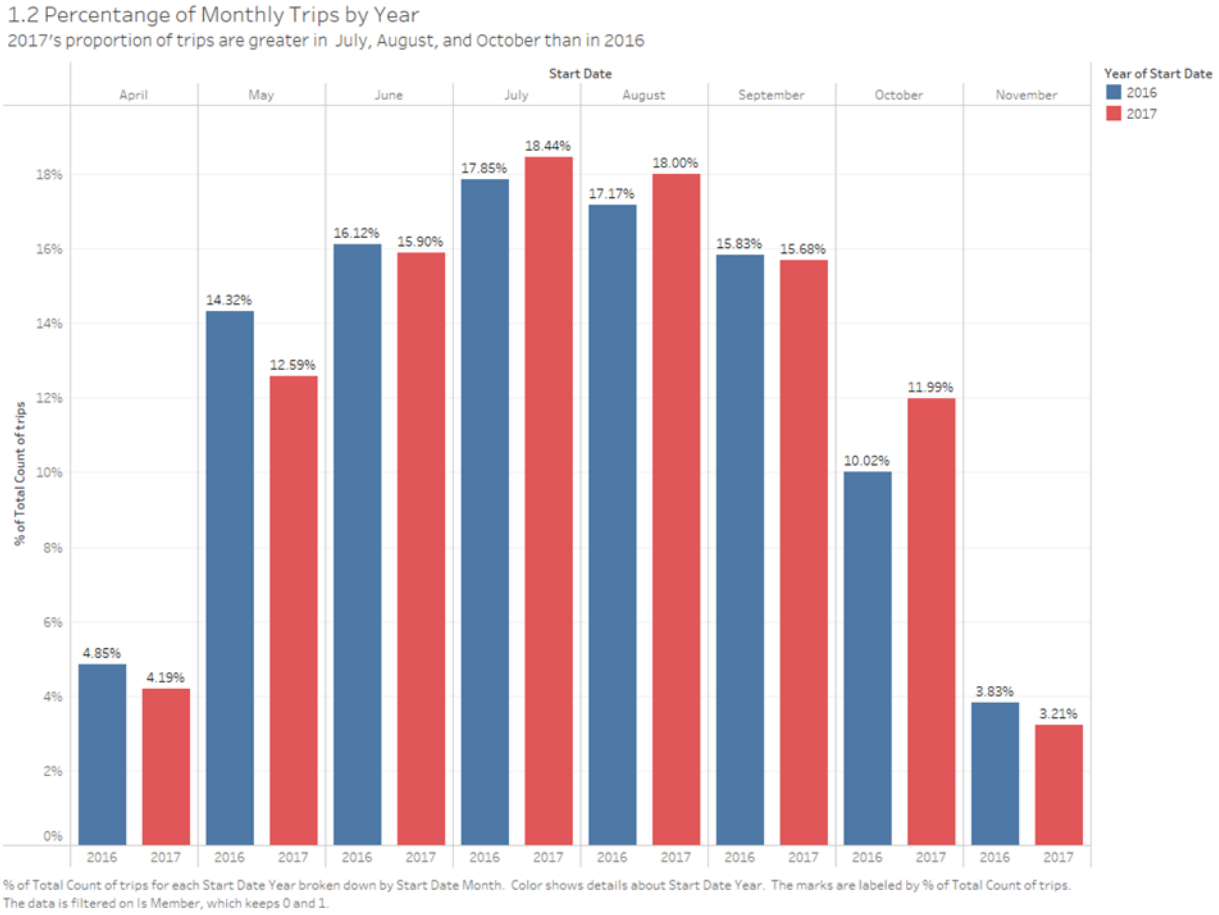
Data Analysis

The first set of analysis performed is to help give general insight into Bixi. Starting off with Bixi's growth of total monthly trips between the two years of 2016 and 2017.



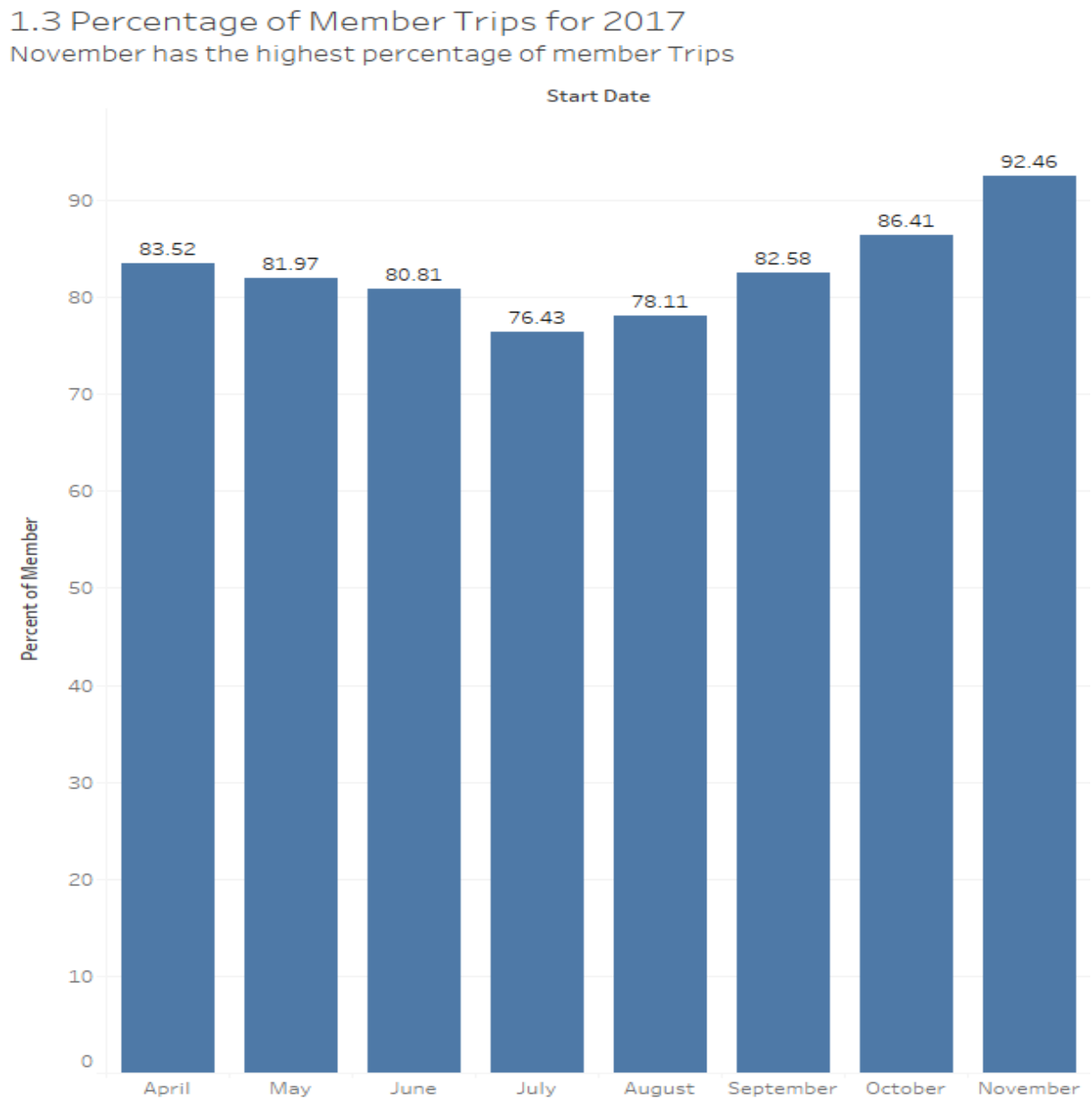
As can be seen from the line graphs overlayed on each other, 2017 has a similar trendline as 2016 but has increased usage in each month except for November. The increased usage is especially noticeable during the summer months and the yearly peak number of trips where 2016 had 699,248 trips and 2017 had 860,732 trips, an increase of approximately 23%.

The next analysis performed was on the proportional monthly usage (relative to that year) of each year and the difference between the two.



The bar graph above further supports that summer months are performing well as the percentage of monthly trips for July and August has increased (as well as October) whereas in 2016, the proportion of monthly trips were greater in the other months when compared to 2017.

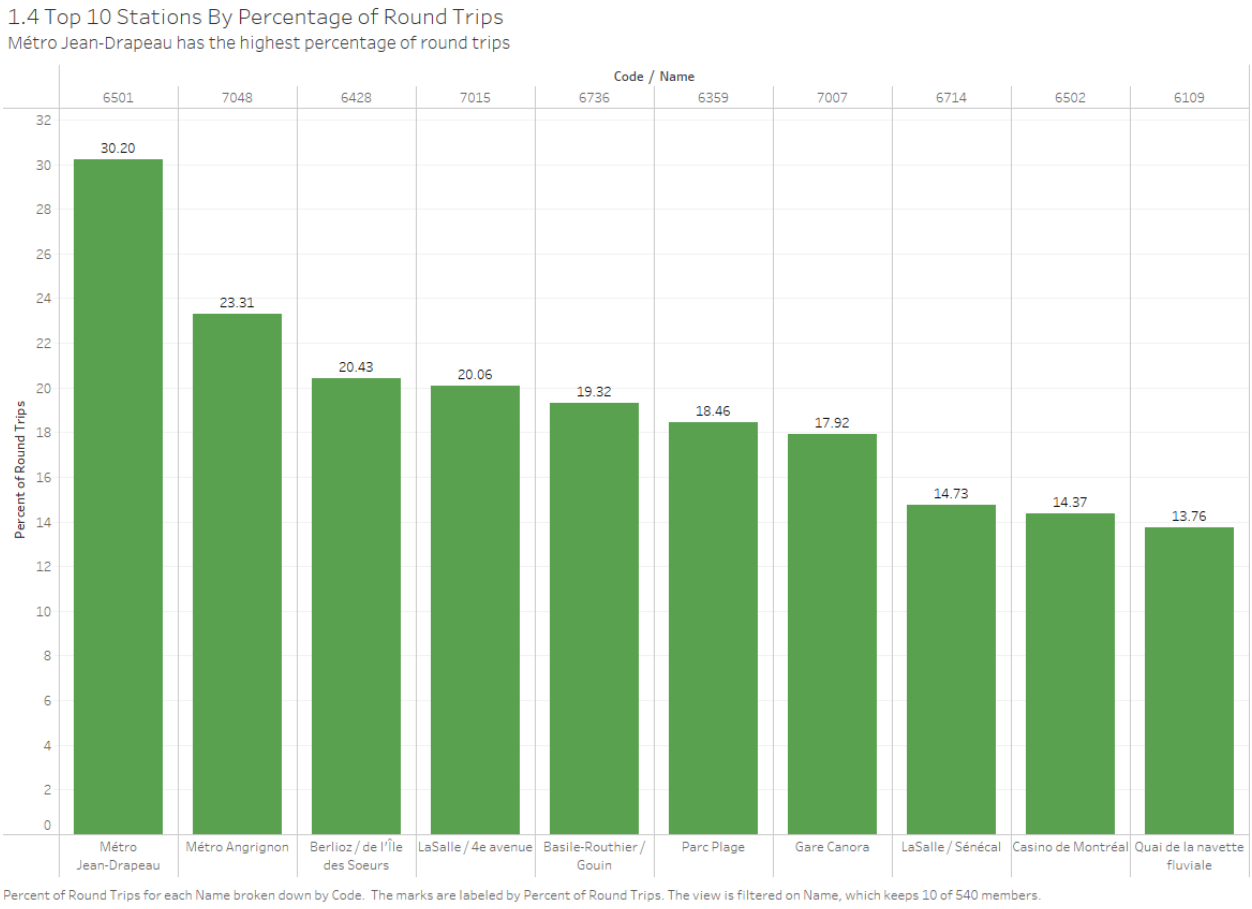
Next, the percentage of trips that were done by members per month for the year 2017 was examined.



Percent of Member for each Start Date Month. The marks are labeled by Percent of Member. The data is filtered on Start Date Year, which keeps 2017.

It can be observed that as we approach summer months, the percentage of member trips goes down and when summer is ending, the percentage of member trips goes back up. It can also be said in terms of non-member trips, that the percentage of non-member trips increases as we approach summer months and decreases when summer ends. This makes sense as when approaching summer, more casual and infrequent riders would go for a bike ride but when entering colder months, less non-members would go out of their way to ride a bike.

Another analysis performed was on the top 10 stations by percentage of round trip usages relative to the station's total trips.

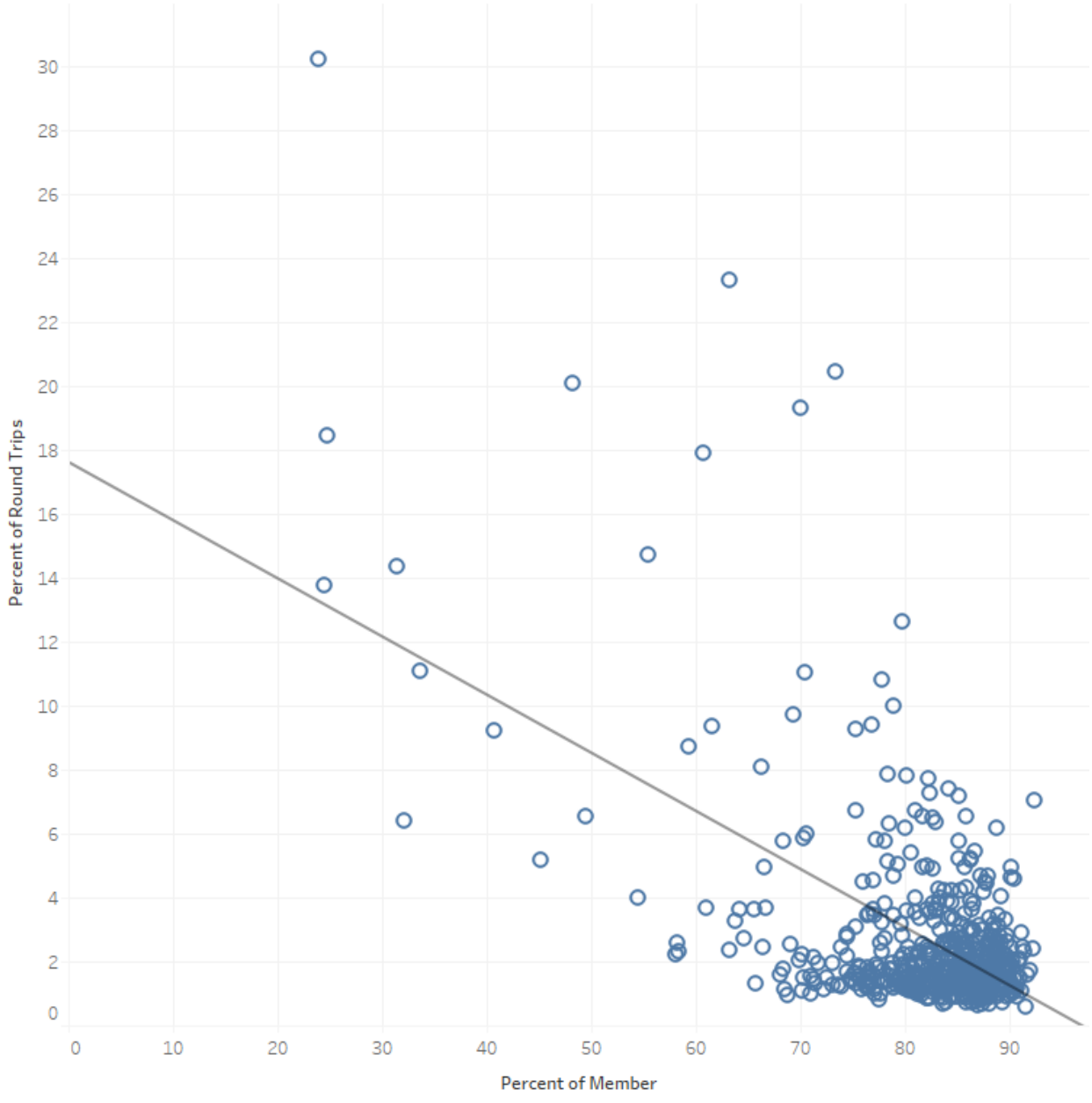


Further research on these locations to gain further insight on factors that make these stations popular for round trips was performed. 'Métro Jean-Drapeau' station is in a popular park which explains why it has a high round trip usage since people ride around the park and return it at the end of their joyride rather than using Bixi as a way of transportation from point A to B. The same could be said for Métro Angrignon and other top stations, and that they are all close to parks or bike friendly locations.

The next set of analysis performed is to aid marketing by seeing people's usage of Bixi's service. Starting off with looking at the relationship between round trips and membership.

2.1 Relationship between Round Trips and Membership

Surprisingly there is a downward trend where the higher amount of members leads to lower amount of round trips for the station



Percent of Member vs. Percent of Round Trips. Details are shown for Start Station Code.

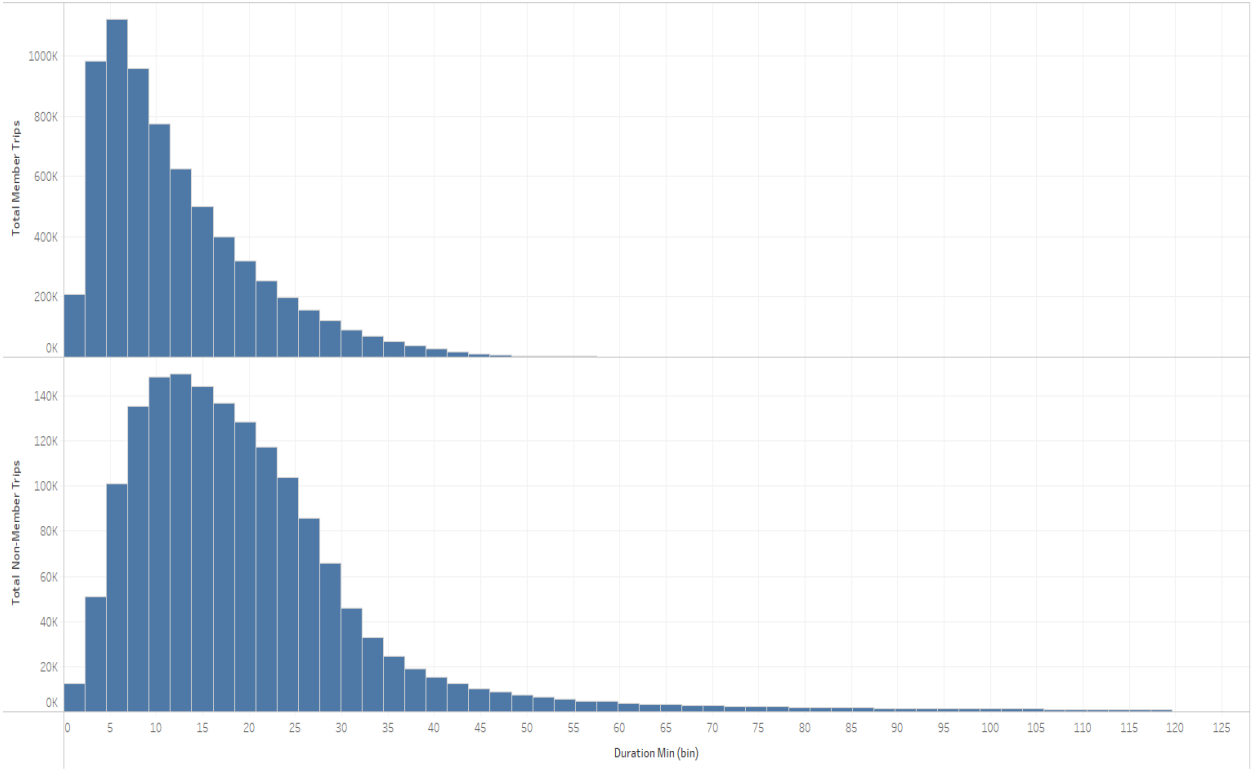
From the scatterplot and trendline, it can be observed that there is a negative correlation between round trips and percentage of members. Meaning that members tend to not do round trips. This gives us some insight that members use Bixi as a form of transportation,

where they go from station A to B, rather than use Bixi as a casual bike ride around an area.

The next analysis performed was on the distribution of trips by duration in minutes between members and non-members. This was done by a side-by-side comparison of the members' histogram on the top and non-members' histogram on the bottom.

2.2 Distribution of Trip Durations by Membership

Members tend to take shorter trips as seen by the peak at 5-7 minutes and a steep decline past that. Non-members are more evenly distributed with a peak at around 12-15 minutes and a steady decline after that.

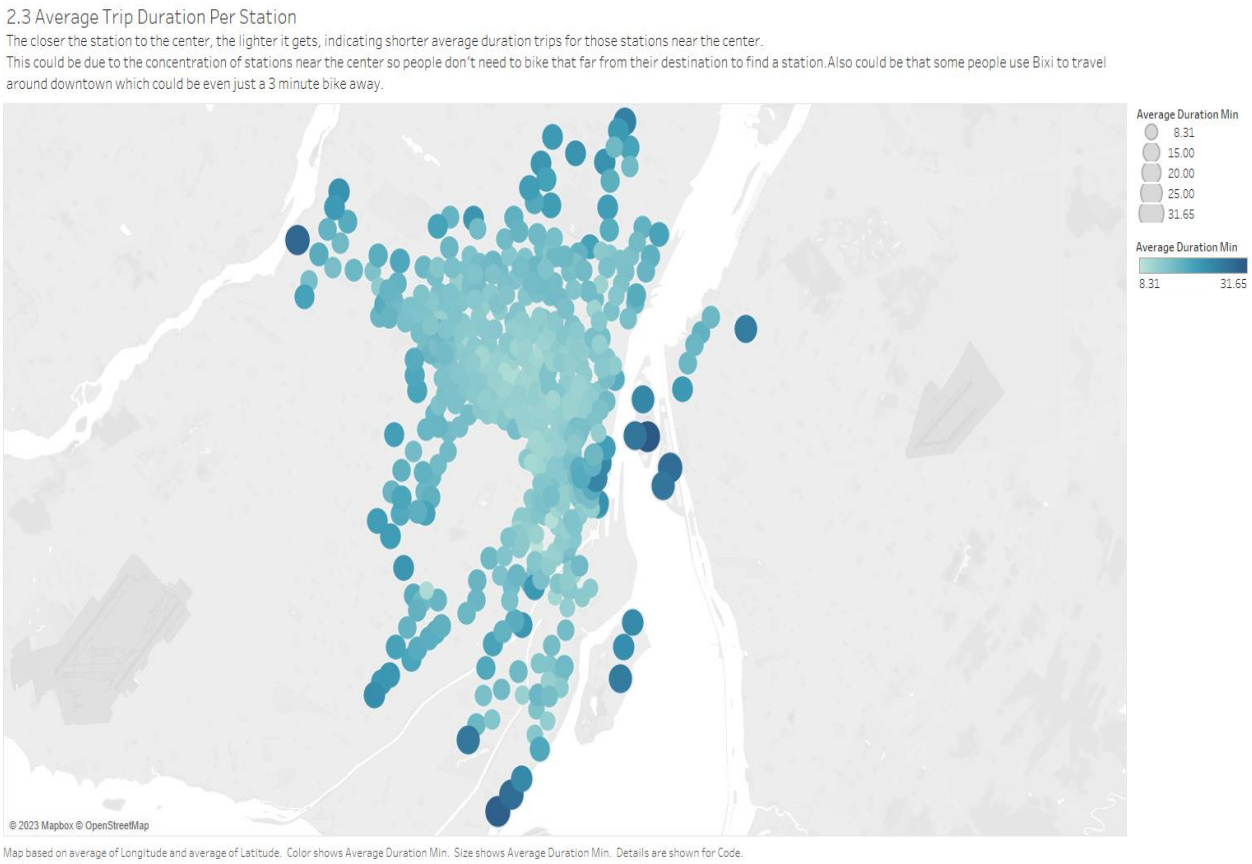


The trends of Total Member Trips and Total Non-Member Trips for Duration Min (bin).

As can be seen from the histograms above, members tend to take shorter trips than non-members as seen by the peak at 5-7 minutes and then a steep decline after that. The non-members' histogram on the other hand shows a more gradual incline until the peak at 12-15 minutes followed by a steadier decline of duration. The difference in behavior of these histograms can probably be explained because membership provides free rides as long as it is under 45 minutes so members will take Bixi whenever they can even if it is for a 5-minute bike ride whereas non-members pay a fee by the minute which might explain the more even distribution of trip duration. A thing to also notice is that past 45 minutes for

members' trip, there are marginal amounts of trips, and this is probably due to the membership only offering a free ride if it is under 45 minutes.

A map was created next to visualize the average trip duration per station.



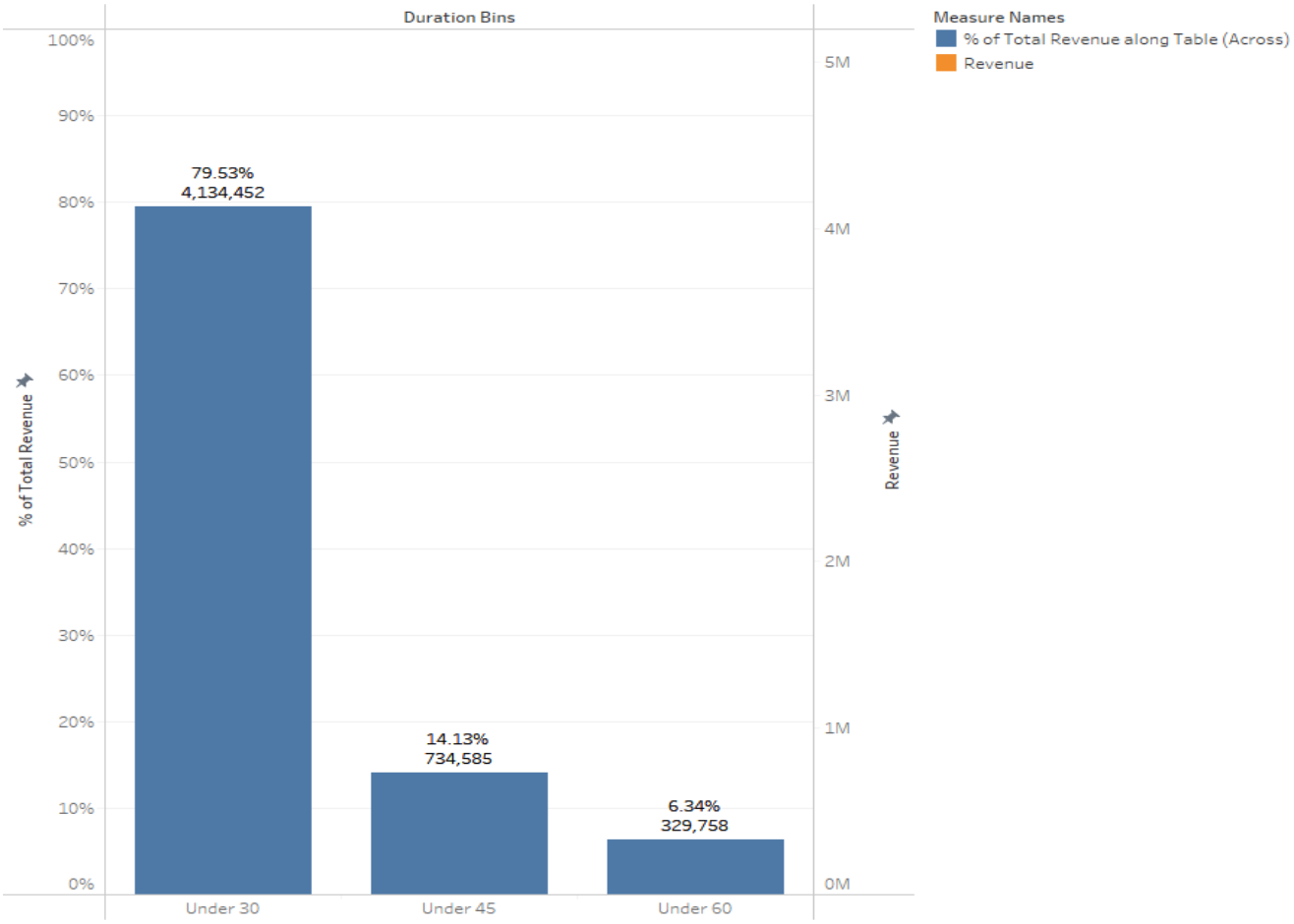
A pattern that can be seen from this map is that as we approach the center of the city, the lighter it gets, indicating shorter average trip duration by station. The opposite can be said as we move away from the center where it gets darker, indicating longer average trip duration by station. This is probably due to the amount of stations near the center so it is easier to travel to a destination and have a station in close proximity to it. Another factor is that since it is downtown there are a lot of places to go and people are using Bixi as a form of transportation to travel even if it a walkable distance (shown from previous analysis that members will take Bixi even if it's a short trip).

The final set of analysis is to get a better understanding on a new pricing model for non-member trips. The pricing model would be as follows:

- $2.99 flat rate for each trip that is 30 minutes or less
- $4.79 ($2.99 + $1.80) for trips greater than 30 minutes, up to 45 minutes in length
- $7.79 ($2.99 + $1.80 + $3) for trips greater than 45 minutes, up to 60 minutes

To approach this, the revenue this would have generated for the total trips of 2016 and 2017 was calculated and visualized.

3.2 Total and Percentage Amount Generated from New Price Model
New pricing model brings a lot of revenue from under 30 minute trips



% of Total Revenue along Table (Across) and Revenue for each Duration Bins. Color shows details about % of Total Revenue along Table (Across) and Revenue. The marks are labeled by % of Total Revenue along Table (Across) and Revenue. The data is filtered on Is Member, which keeps 0.

As shown in the bar graph above, most revenue would come from 30 minutes or less trips where, 79.53% of revenue generated by this new pricing model would come from under 30 minutes or less trips, in comparison to 14.13% and 6.34% revenue generated for 30-45 and 45-60 minute trips respectively. In terms of dollars, that would be $4,134,452 from under 30 minute trips, $734,585 from 30-45 minute trips and $329,758 from 45-60 minute trips which is $5,198,795 from this pricing model. Since the majority of revenue was from 30 minutes or less trip, further breakdown on this new model was performed on the total revenue generated per hour per day for 30 minutes or less trips.

3.3 Breakdown of Revenue by Hour and Weekday

Weekends during the afternoon (2pm - 6pm) is when this model would be generating the most revenue

Sum of Revenue for each Start Date Hour broken down by Start Date Weekday. Color shows sum of Revenue. The marks are labeled by sum of Revenue. The data is filtered on Duration Bins and Is Member. The Duration Bins filter keeps Under 30. The Is Member filter keeps 0.

It can be seen from the figure above that the weekends, Saturday and especially Sunday generate the most revenue especially around the afternoon (2PM-6PM). This would make sense since the trips of non-members are being observed so casual riders would be riding more during the weekends and afternoon would be the perfect conditions for the day. Weekdays seem to generate the most revenue around 5PM which make sense since that's after work hours.

Conclusion

In conclusion, Bixi is a business that is seeing growth as the use and popularity increases each year, especially during the summer months. A reason for Bixi's growth could be because more casual bike riders are using the service as well as maybe more tourists using Bixi as seen from the increase in usage as well as increase in non-member trips in summer months. Another main reason could be that more people are starting to use Bixi as a form of transportation as shown from the second set of analysis where users tend to take short and one-way trips especially in the downtown core. Taking advantage of these short trips by introducing a flat fee could significantly increase revenue but cannot be confirmed from the analysis performed in this report. Further analysis on tradeoff needs to be done as just manipulating past trips usage might not be reality as introducing this flat fee could reduce Bixi usage and even bring less revenue than the current revenue model.