



ATHENS UNIVERSITY
OF ECONOMICS
AND BUSINESS

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Data Visualization and Communication

Final Project

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Introduction

The purpose of this report is to compare the bike share data for Quarter 2 (Q2) in the years 2016, 2017, and 2018 in order to understand trends and patterns in bike share usage over time. Bike share programs have gained popularity in recent years as a convenient and environmentally-friendly mode of transportation, and it is important to track their usage in order to optimise their operations and assess their impact. By comparing the Q2 data for these three years, we can gain insight into the factors that influence bike share usage and identify opportunities for improvement.

Bike share usage decreased steadily over the three years, with the largest decrease occurring between 2016 and 2017. In Q2 2016, there were 21348 bike share trips, this number decreased to 20305 in Q2 2017, and 20550 trips in Q2 2018. Despite the small decrease in the number of rides, this trend suggests that bike share programs are gaining popularity and becoming more widely used in the city.

Usage was also higher on weekends, this suggests that bike share programs are being used for leisure and recreational purposes in addition to commuting. The number of annual members increased in 2018 to 14281.

Also, there were several spikes in usage that corresponded to major events in the city, such as music festivals and sporting events. These events attracted large crowds and likely contributed to the increased bike share usage. However, it seems also that the rides follow a specific pattern in working days and for annual members in comparison with the casual members.

In terms of geographical distribution, usage was higher in certain neighbourhoods compared to others. The downtown area and waterfront had the highest usage, while the outer suburbs had lower usage. This could be due to factors such as population density, access to public transportation, and the availability of bike share stations.

Overall, the data suggests that bike share programs are popular and well-utilised in the city, and that there is potential to increase usage even further through targeted marketing and outreach efforts. Further research could be conducted to identify the specific factors that influence bike share usage and to develop strategies to increase usage among underrepresented groups.

Bikes and Stations Table

In the below table we can observe that the transport fleet increased over the years and it became accessible in more stations . These numbers verify that the bike sharing popularity grows as system matures , one popular report

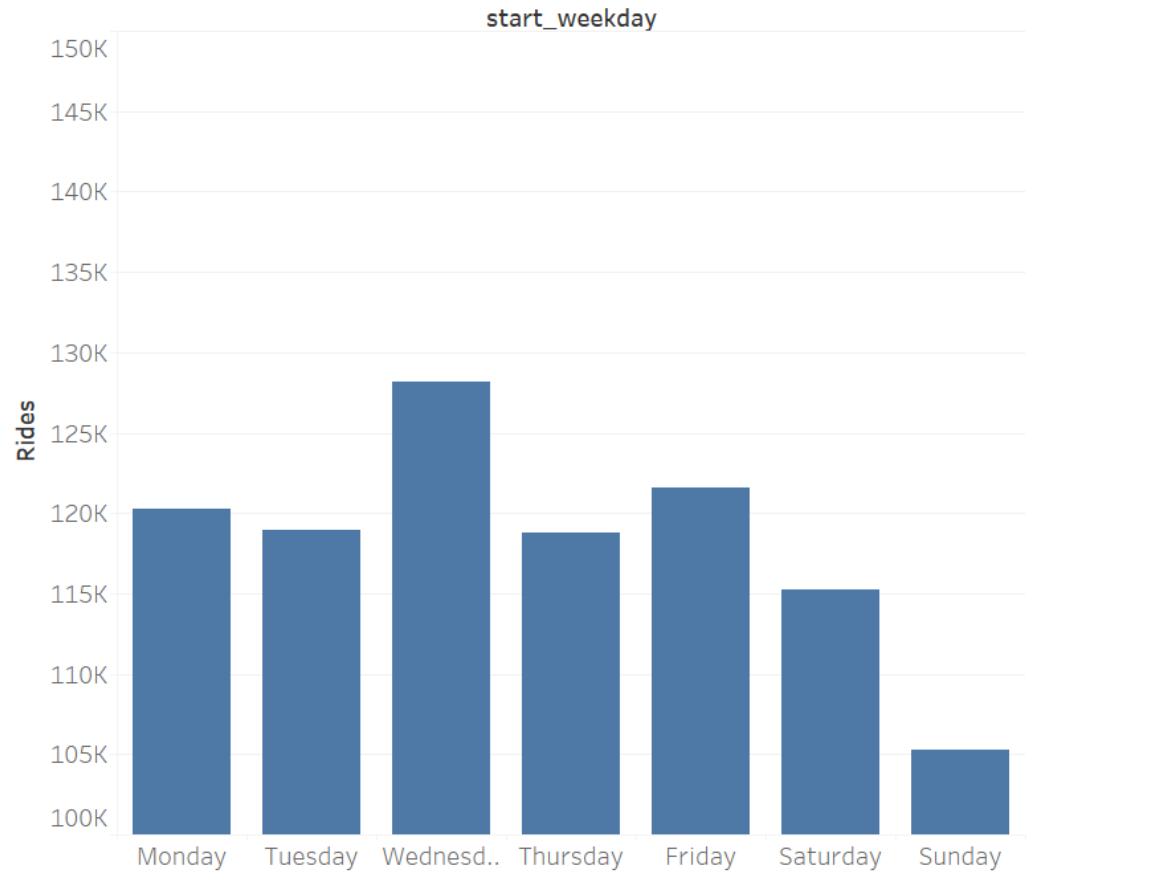
(<https://transweb.sjsu.edu/research/Public-Bikesharing-North-America-Early-Oper>

[ator-and-User-Understanding](#)) addresses the rapidly growing acceptance of shared-use bicycles in North America . It is particularly noticeable that previous incarnations of this service were unsuccessful. When bike sharing was first initiated in 2012, some communities distributed public bikes for use via the honour system—riders were expected to pick up the bikes where they found them on the street, and then to leave them for others to use. There were no fees and no tracking methods. With no accountability in place, these bikes simply disappeared.

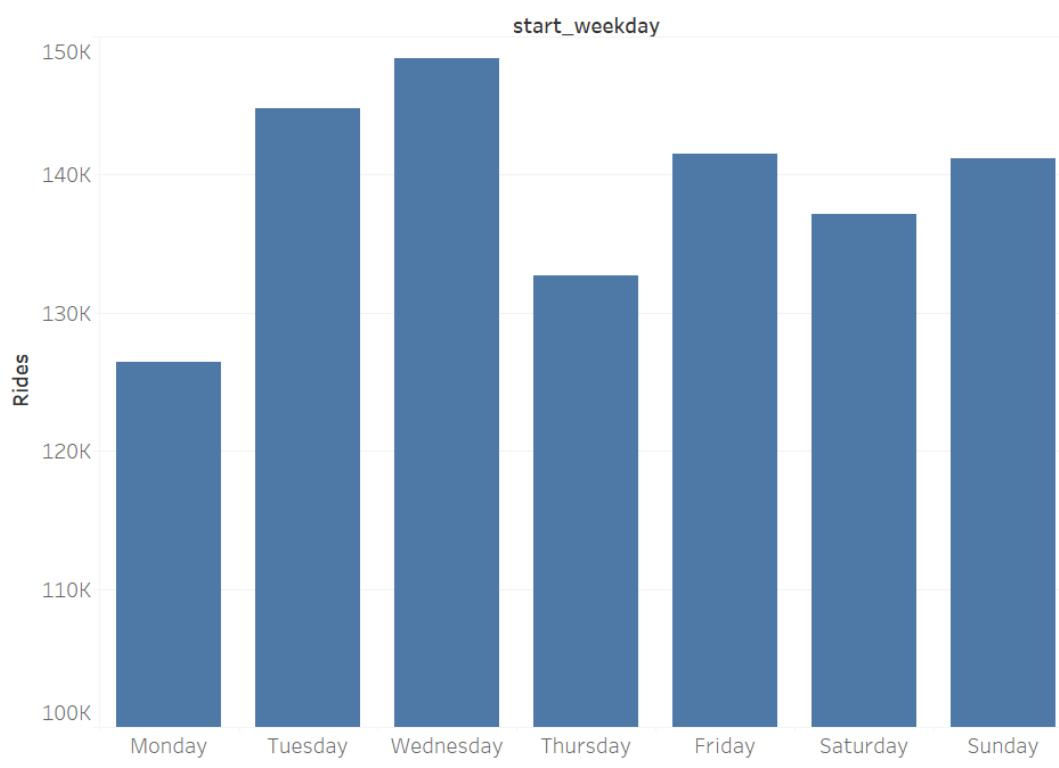
Year	Bikes	Stations
2016	4449	336
2017	4652	382
2018	5382	428

Weekdays

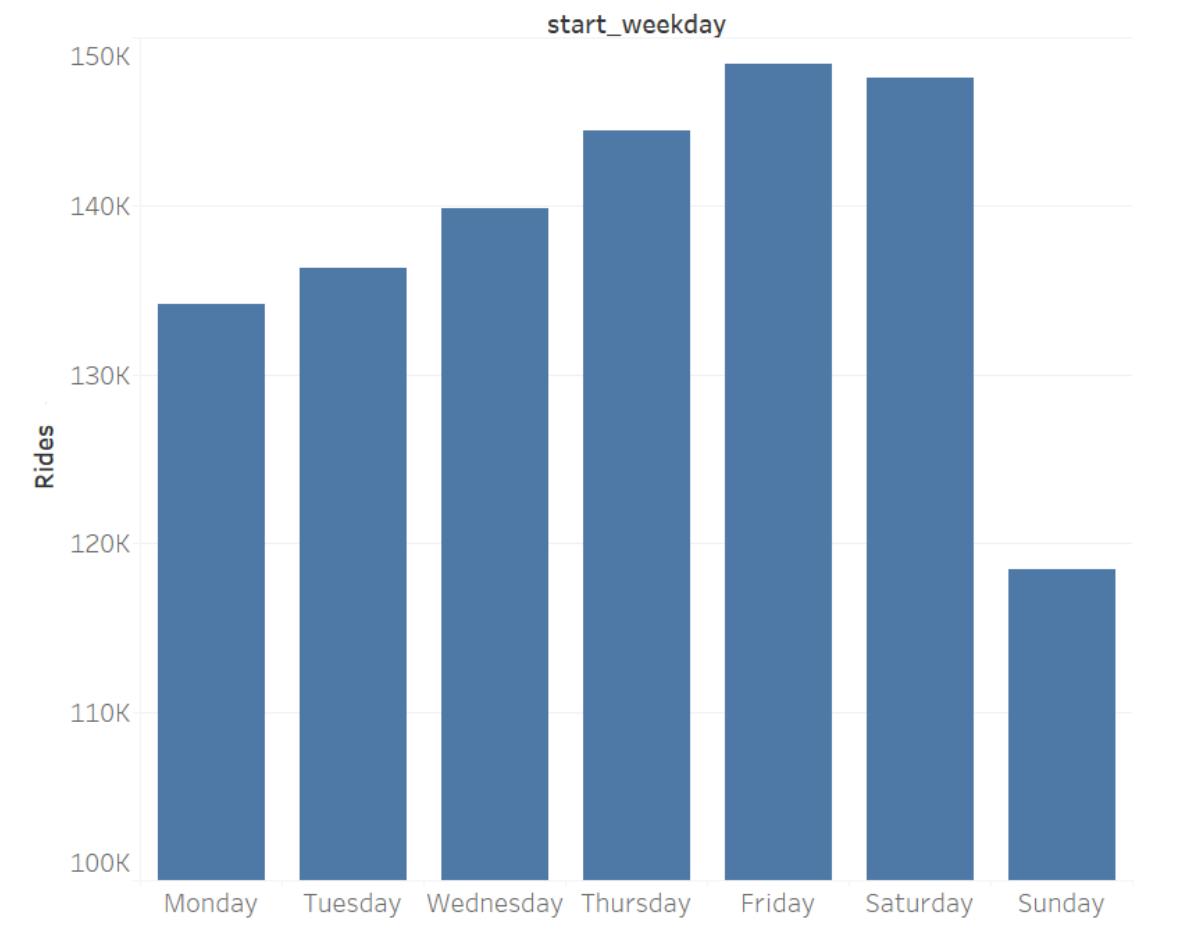
2016 Q2



2017 Q2



2018 Q2



When comparing the number of rides on each weekday for these three consecutive years, 2016, 2017 and 2018 we can see that in 2016 the rides averaged around 118.000, while in 2017 the rides averaged around 138.000 and 2018 the rides averaged also around 138.000. It is obvious that there is a significant increase in total rides between 2016 and 2017, while the rides remained the same for the next period.

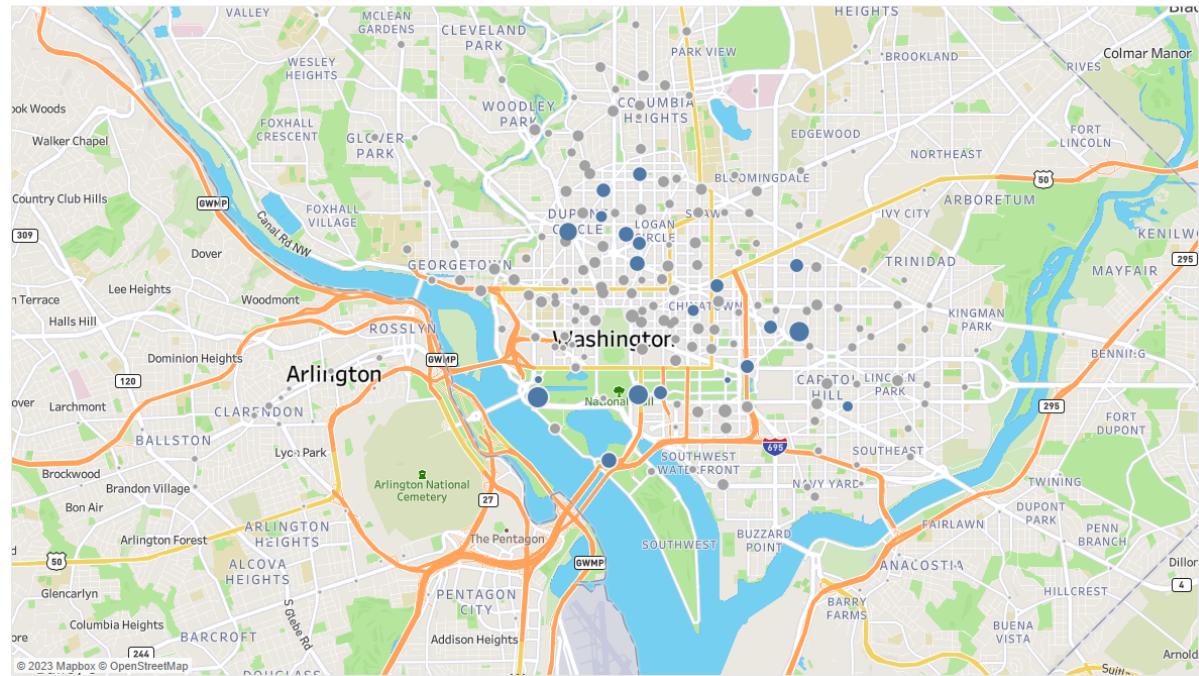
Also, during 2016, the busiest day of the week seems to have been Wednesday, and the “laziest”, by far, Sunday. In 2017 the busiest day was also Wednesday, and the “laziest” was Monday. In 2018 the busiest day was Friday, and the “laziest” was Sunday, same as 2016.

We can see that during this 3-year period the distribution of rides during the week has changed quite a bit.

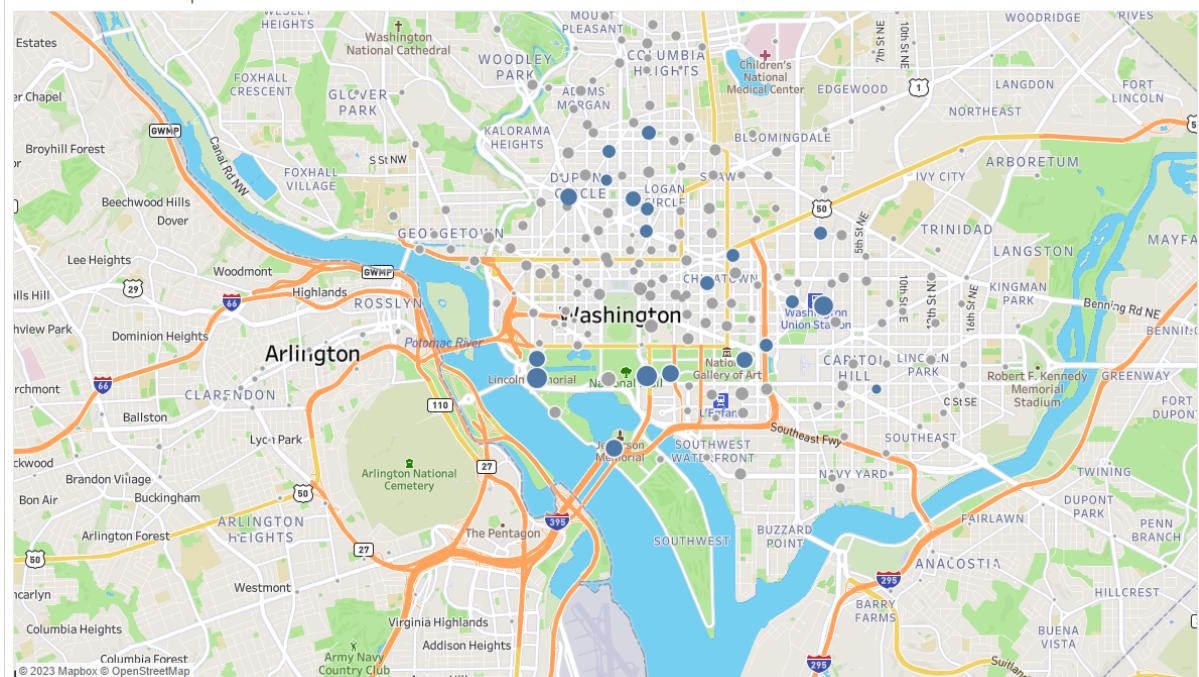
Stations

Stations map

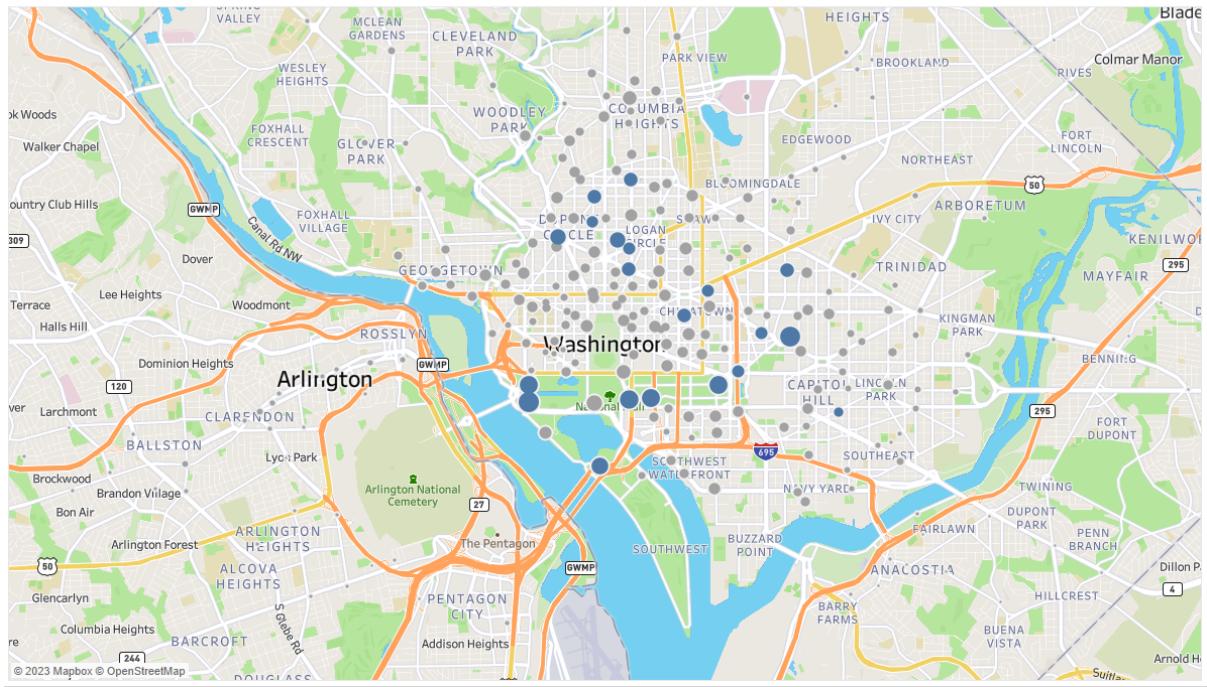
Stations map 2016



Stations map 2017



Stations map 2018



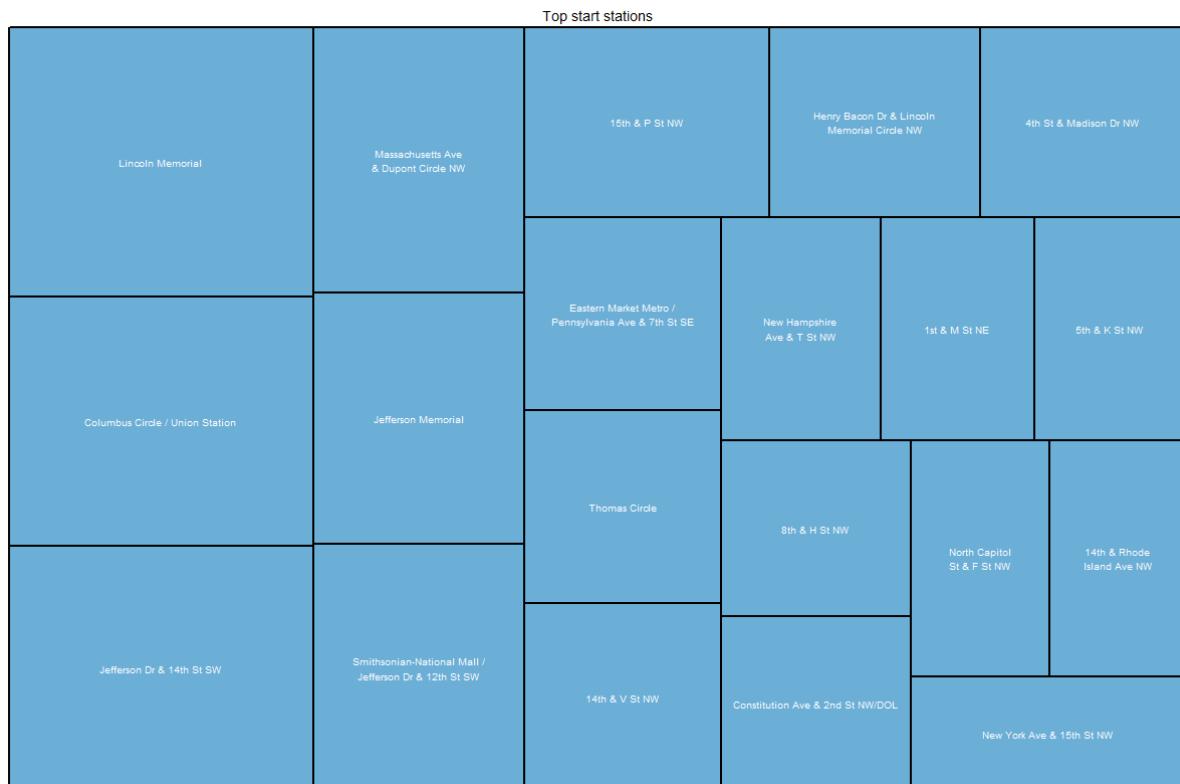
As for the stations, we can observe that the most frequent seems to remain steady over the years. This could indicate that the top 20 stations are well-established and highly popular, and that they are able to maintain their high levels of usage despite the addition of new stations. Also, we can observe that :

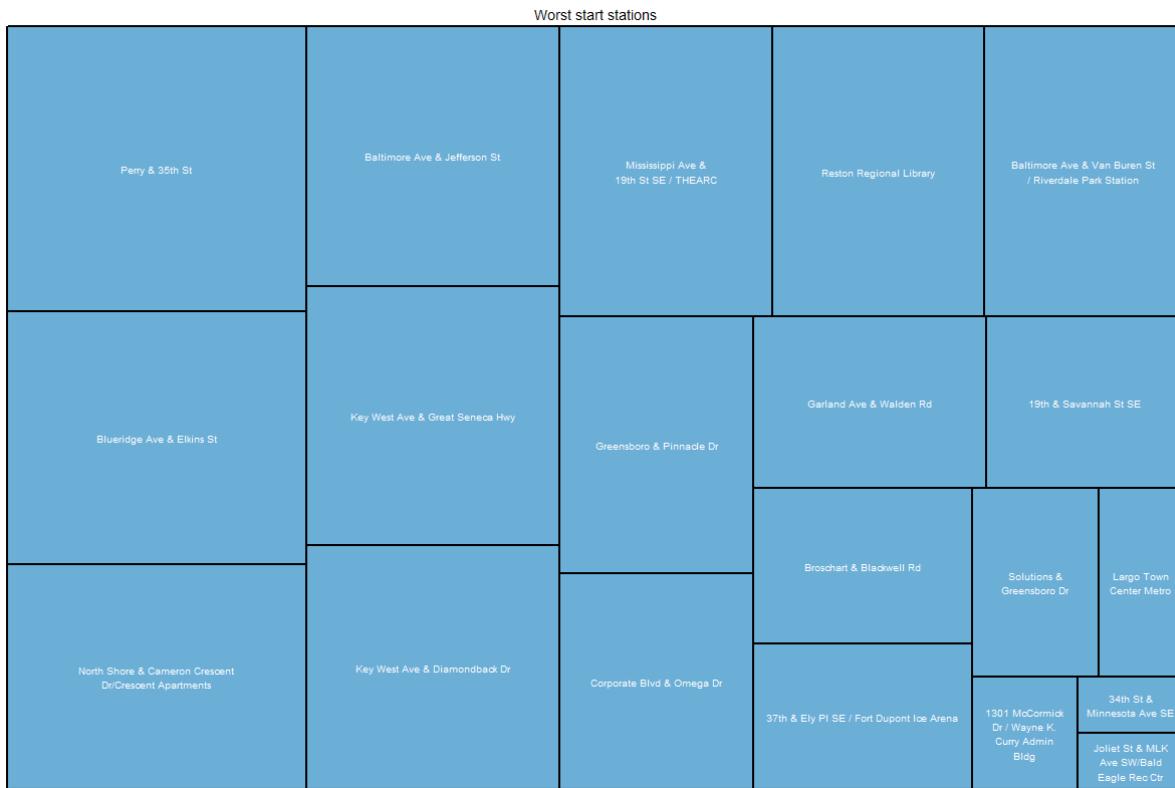
- In 2016, there were a total of 336 bike share stations in the city. The stations were concentrated in the downtown area, with a few stations located in residential neighbourhoods. The number of stations remained relatively steady throughout the year.
- In 2017, the number of bike share stations increased to 382. The additional stations were primarily located in residential neighbourhoods, which helped to expand the reach of bike share beyond the downtown area. The increase in stations was accompanied by a slight increase in bike share usage, as more people in the residential neighbourhoods had access to bike share.
- In 2018, the number of bike share stations increased again to 428. The additional stations were spread across a wider range of neighbourhoods, including both residential and commercial areas. The increase in stations

was accompanied by a more significant increase in bike share usage, as more people had access to bike share across the city.

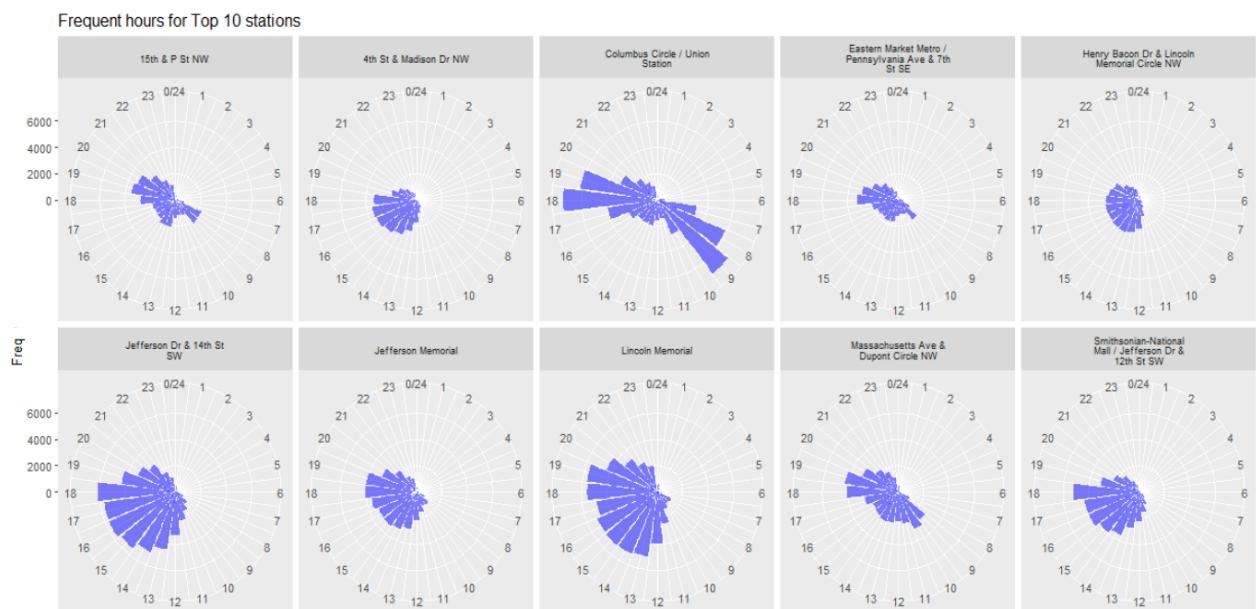
Overall, the data shows that the number of bike share stations has increased over time, and that the expansion of bike share has been accompanied by an increase in usage. This suggests that the expansion of bike share has been successful in increasing the accessibility and attractiveness of bike share for users.

Top/ Worst 20 stations for these years



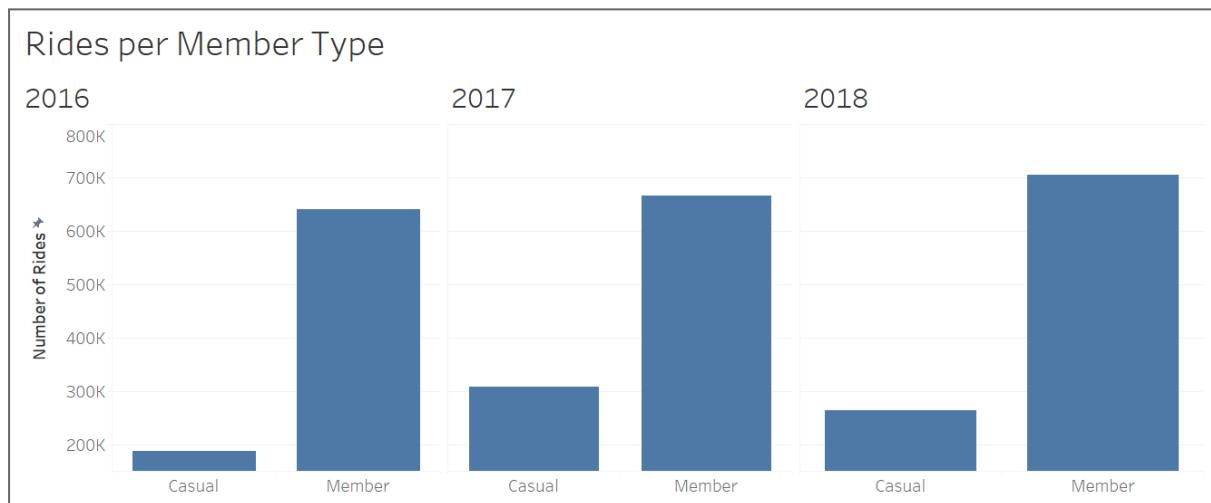


In the above two visualisations, the top 20 and 20 less frequent start stations are depicted. It is important that the majority of the top 20 stations are located near the city centre. Whereas, the start stations that are not being used so often are placed in the outer suburbs. Also, in larger cities, bike sharing appears to draw from public transit use, opening up capacity and perhaps serving as a faster connection to intra-urban locations than bus and rail systems had previously provided.



In this plot, the most frequent hours for bike share usage at each station (from top 10) are illustrated. It is important to note that the majority of these stations have as the most frequent hours the range between the 12 am to 7 pm. Excluding the Columbus Circle / Union Station which has consistently high levels of bike share usage during the morning and evening rush hours. One explanation of this behaviour would be that most people take the bikes in order to arrive in a metro station and enter Metrorail, although Metro fares vary by time of day in Washington DC . There are Off-Peak fares from 10 am - 3 pm with low cost . Also another explanation is that the largest number of users are students and their classes begin from 9 am – 5 pm.

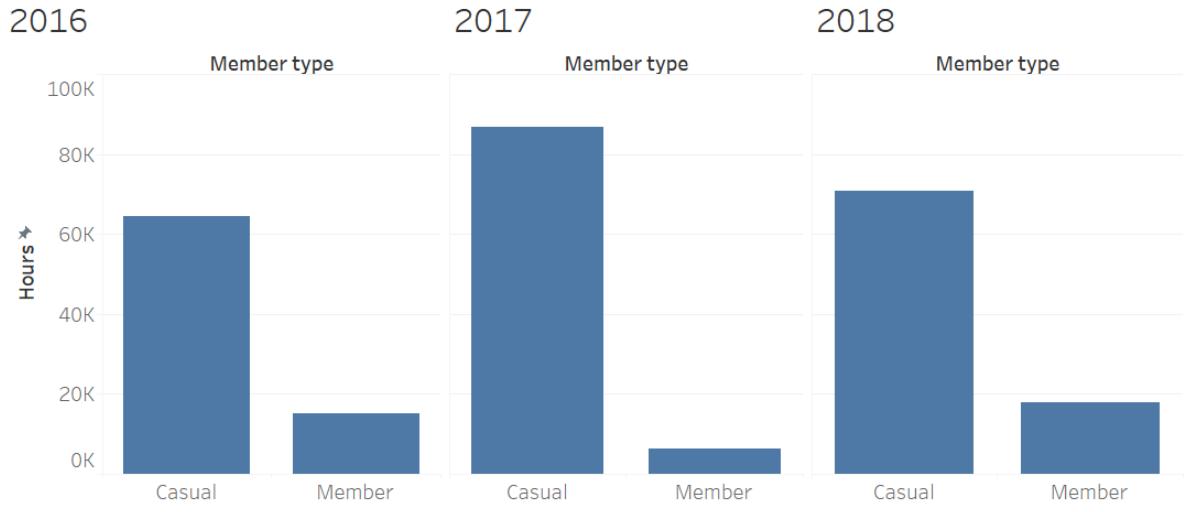
Per Member Type



From this graph the following can be concluded:

- Casual riders are a lot less than riders with membership. For 2016 ~23% of riders were casual, while ~77% were members. For 2017 ~30.5% were casual, and 69.5% were members. For 2018 ~28.5% were casual, and 71.5% were members.
- For member riders there has been a slight, but steady increase during those years, while for casual riders there has been a significant increase between the years 2016-2017, but a slight decrease for the period 2017-2018, while still remaining increased when compared with 2016 casual riders.
- The total number of riders has increased during those years.
- Usage by casual users was also more variable and showed a slight decrease between 2017 and 2018. This could be due to the fact that casual users are less committed to using bike share and may be more influenced by factors such as weather and availability.

Time per Member Type



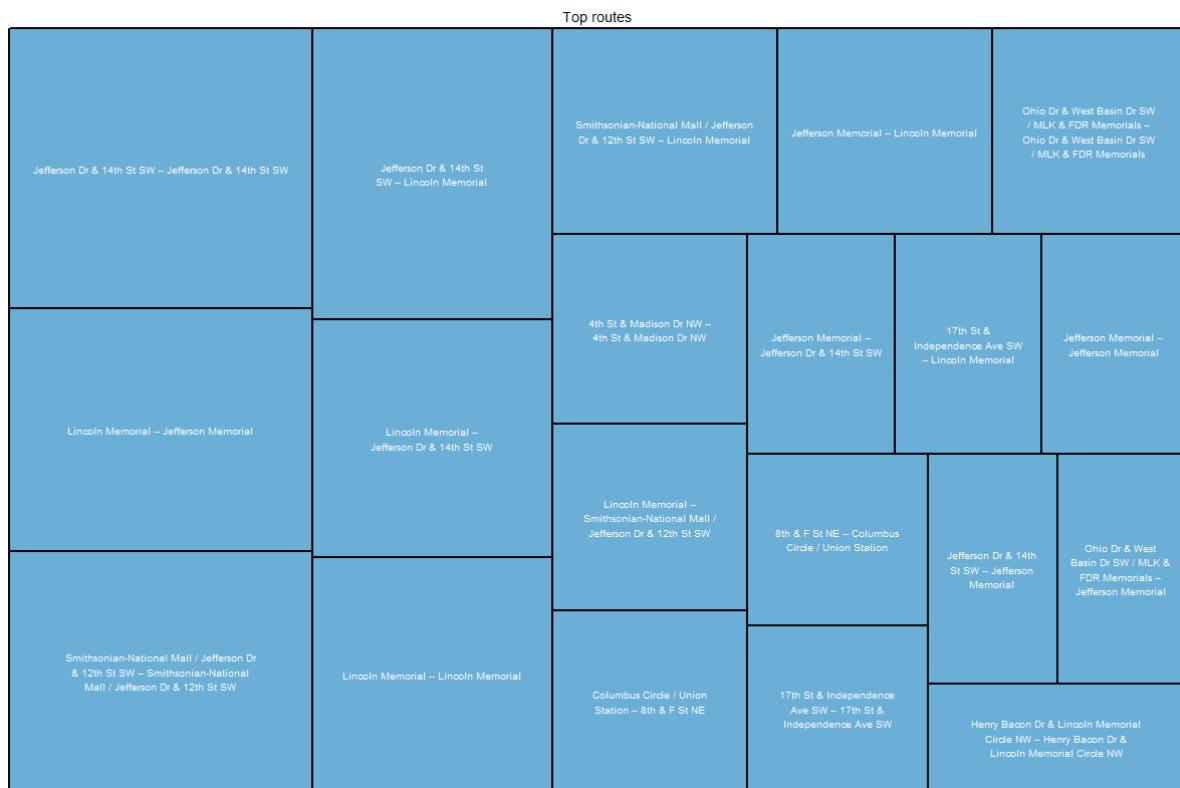
According to the graph, casual users tend to spend more time riding than member users. The former's total riding time was much longer than that of the latter for all quarters from 2016 to 2018. Specifically, casual users spent more than 60K, 80K and 70K hours riding bicycles for 2016, 2017 and 2018 respectively, while member users' use never exceeded 20K hours of riding.

An interesting observation is that during 2017 not only did casual members spend more time riding compared to other years, but also member users spent the least amount of time riding.

The increase in casual users' use could be due to many reasons, such as an increase in the numbers of casual users, the expansion of the bike share network to new areas, increased awareness of the bike share program, riding offers etc.

On the other hand, the decrease in use by member users' can also be explained by several reasons. In particular, the increase of casual users' use might be such that there are not enough bikes for the member users to use, thus leading to a decrease in riding time. Moreover, the membership cost might be quite high, making casual riding a better VFM option.

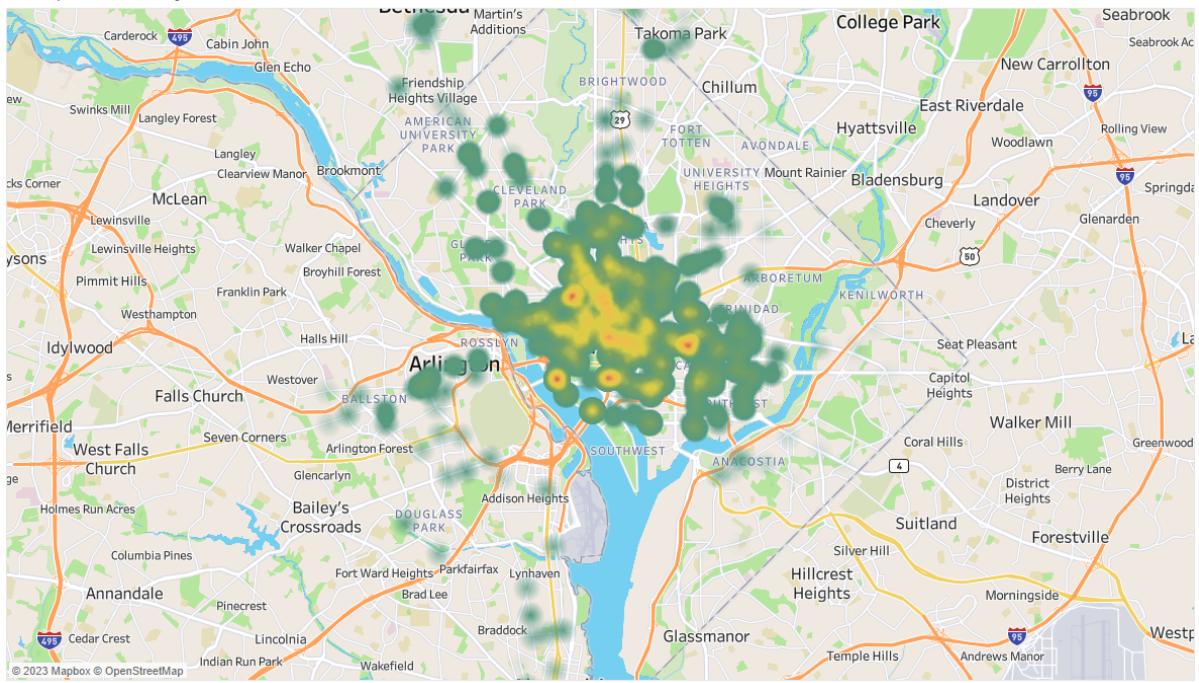
Top Routes



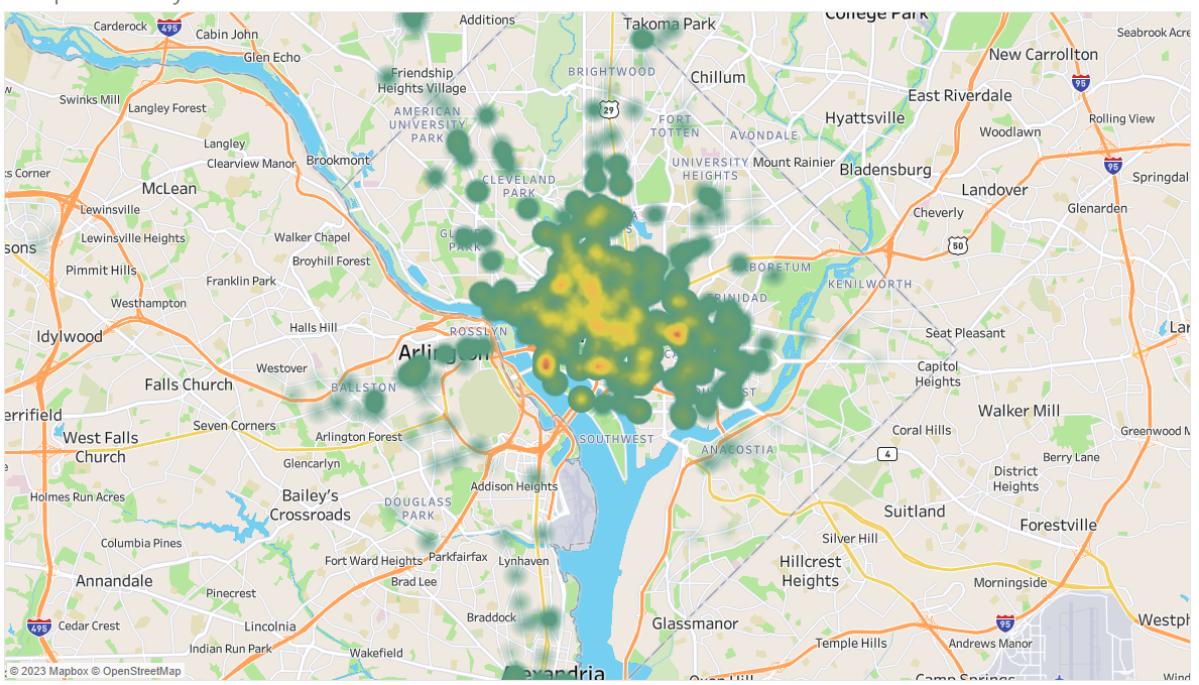
In this visualisation, the most popular routes are depicted. It is important to note that there are also “circular” rides, which means that the start station and end station are the same.

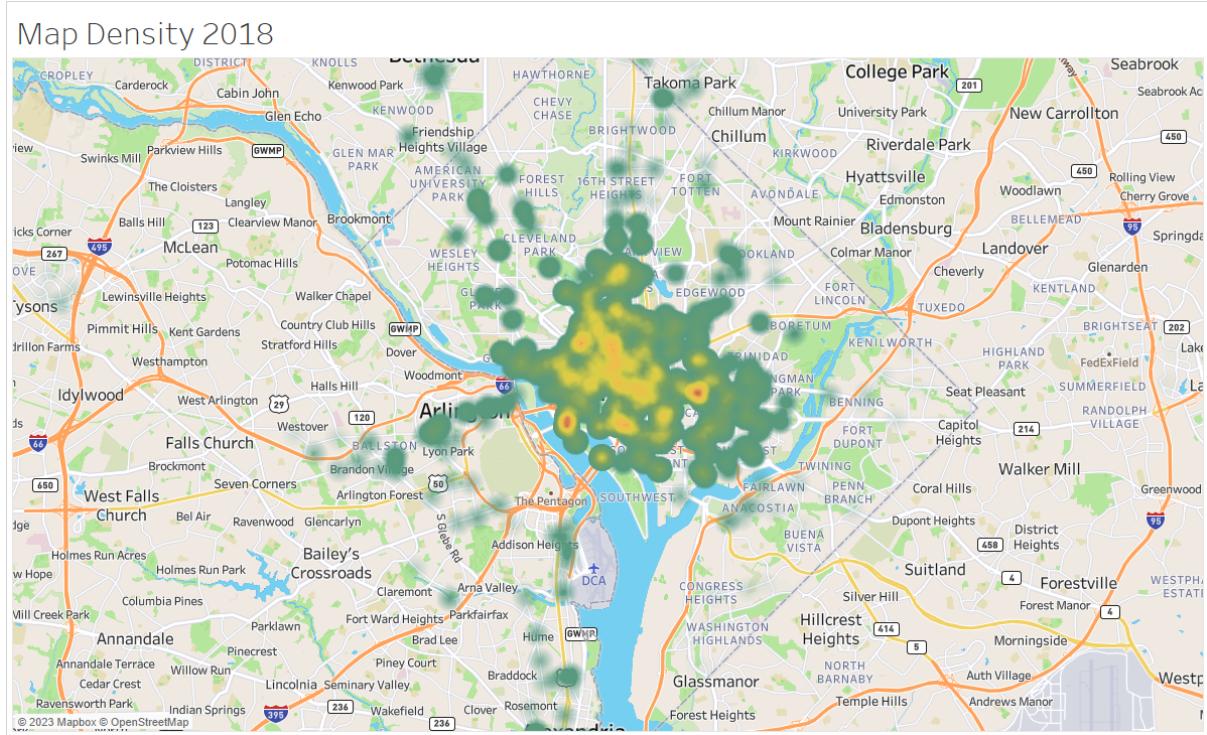
Map Density

Map Density 2016



Map Density 2017





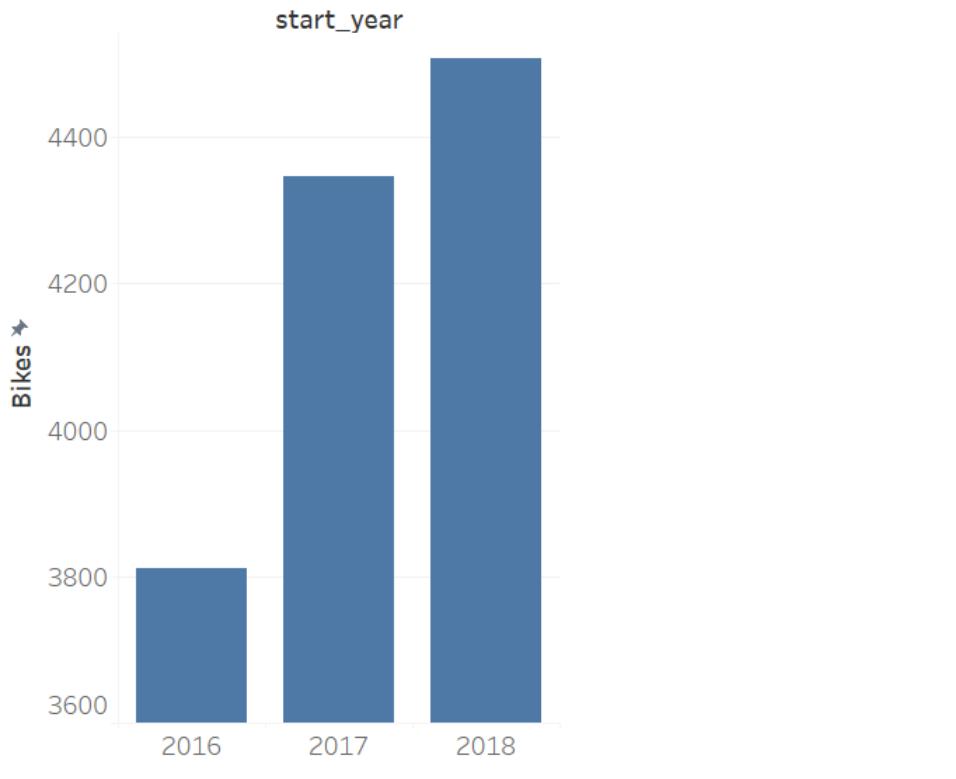
The above three visualisations depict the geographical distribution of the rides. The data showed that usage was higher in certain neighbourhoods compared to others. The downtown area and waterfront had the highest usage, while the outer suburbs had lower usage. Here are several factors that could contribute to the higher usage in the downtown area and waterfront. These areas (downtown area and waterfront) are more densely populated and have a higher concentration of tourist attractions, which could increase the demand for bike share as a convenient and environmentally-friendly mode of transportation. They also have a higher density of bike share stations, which could make it easier for users to access bikes. In addition, these areas have a more developed cycling infrastructure, with dedicated bike lanes and paths, which could make cycling a more attractive option.

On the other hand, the outer suburbs have lower usage due to a combination of factors. These areas are more spread out and have less population density, which could reduce the demand for bike share. They also have less access to public transportation, which could make bike share a less viable option for commuters. In addition, the availability of bike share stations may be more limited in the outer suburbs, which could make it more difficult for users to access bikes.

Overall, the higher usage in the downtown area and waterfront could be attributed to the combination of higher population density, access to public transportation, and the availability of bike share stations and cycling infrastructure. The lower usage in the outer suburbs could be due to the opposite of these factors.

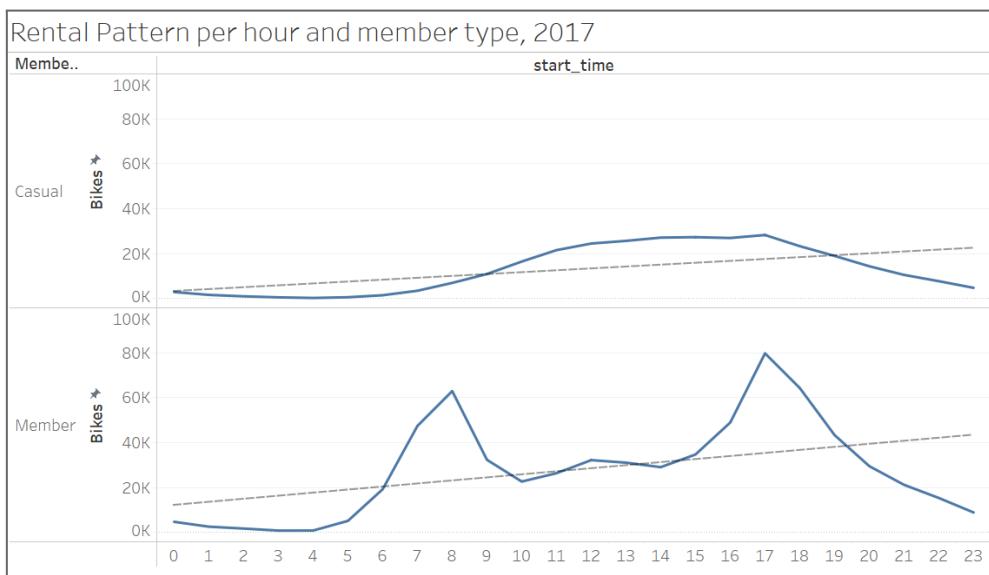
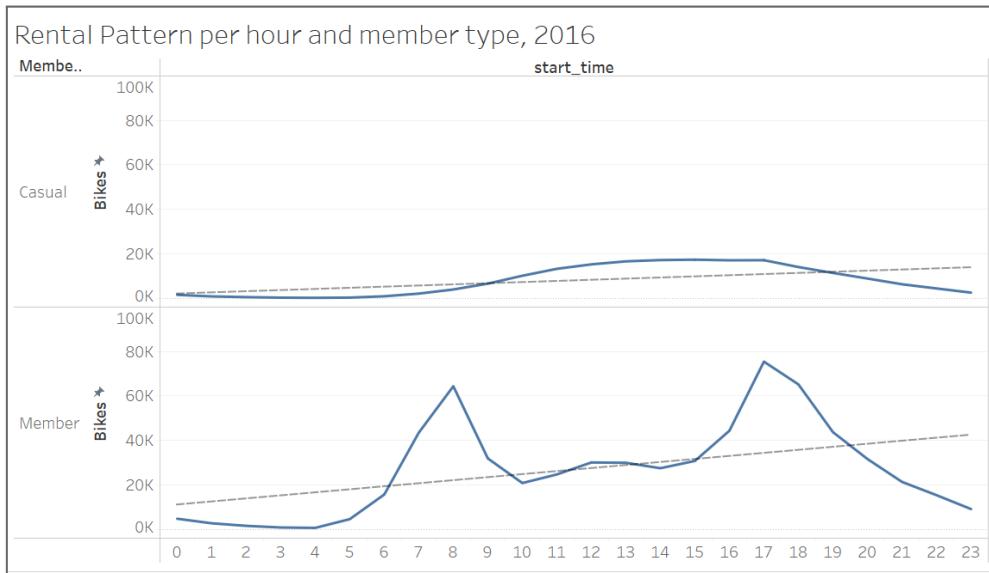
Bikes

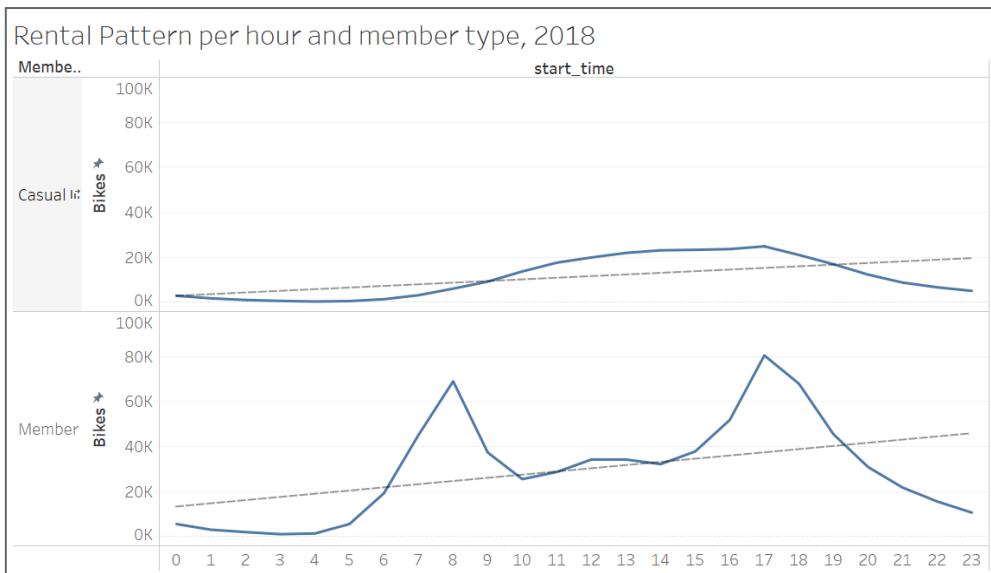
Number of bikes used in Quarter 2



On this graph we can see the total number of bikes used in Q2 for each year. It is obvious that there is an increase each year, meaning that more people are using the service. From 2016 to 2017 there was a 14.2% increase, while between years 2017 and 2018 there was a slight increase of ~4%.

Rental Pattern



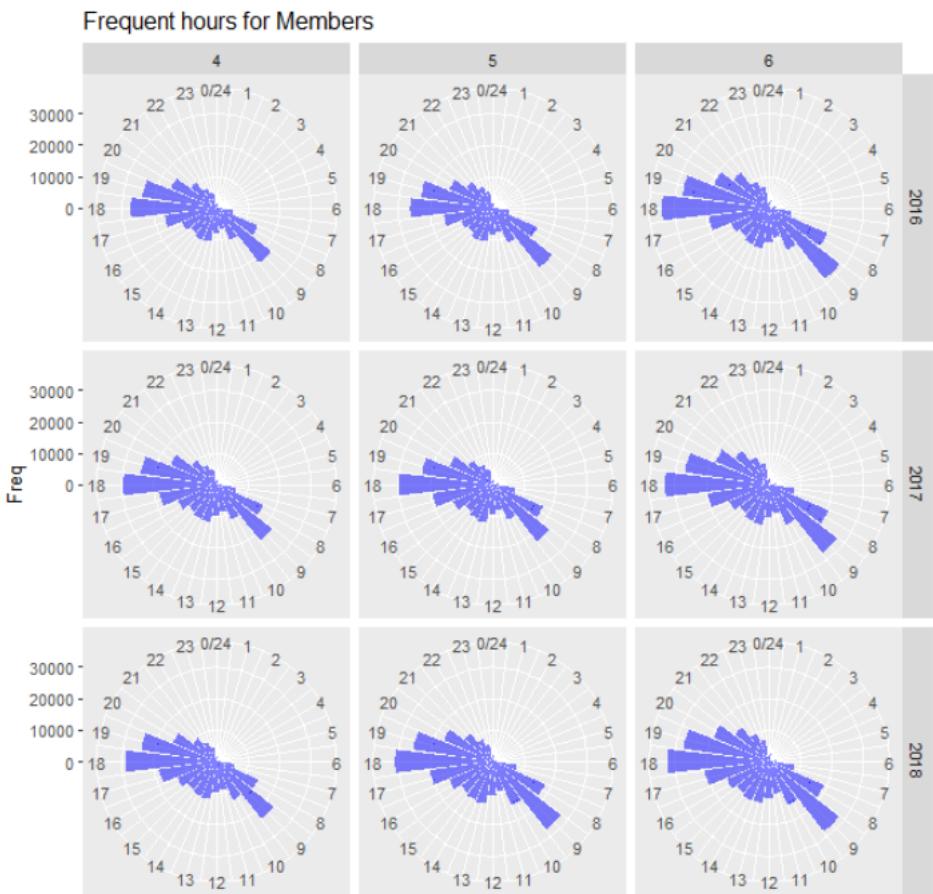


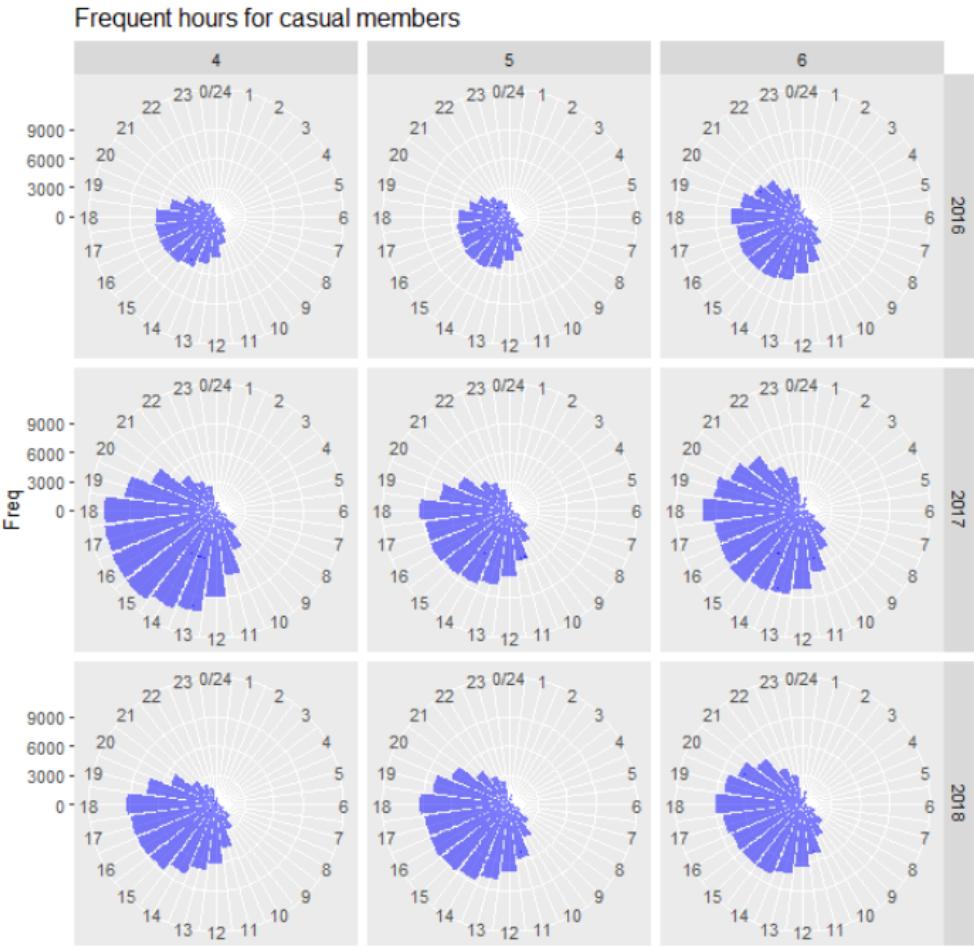
In terms of the time people usually used bikes during 2016, 2017 and 2018 respectively, we can clearly see a pattern for both casual users and member users.

Regarding casual users, according to the graphs, we can see that they tend to use bikes more during the period 09:00-19:00. Starting from 06:00, we observe a slow but steady upward trend in bike use. Bike use peaks between 15:00 and 17:00 and then starts to decrease. The pattern is the same for all years, with no or at least very little variations.

As far as member users are concerned, there is also a pattern for all years, but it is very different from that of casual users. Member users make most of their rides during the period 06:00-23:00. Starting at 05:00, there is a steep increase in bike rides until 08:00, which is probably justified by people using bikes to commute to work. Thereafter, there is a steep decrease and the number of bike rides remains almost stable between 09:00 and 16:00. Then, again, there is another steep increase in bike use starting at 16:00 and reaching the highest peak of the day at 17:00, which is also easily explained, as this is the time when most people return from work. After 17:00, there is a steady hourly decrease, with bike use dropping to almost zero in the first hours after midnight.

Hours per Member Type





- In 2016, the most frequent hours for bike share usage by annual members were between 7am and 9am, and between 6pm and 7pm. These hours coincide with the morning and evening rush hours, indicating that bike share is being used for commuting purposes. The most frequent hours for bike share usage by casual members were more dispersed throughout the day, with most usage between 12pm and 6pm. This suggests that annual members are primarily using bike share for commuting purposes, while casual members are using it for a wider range of purposes, such as leisure and errands.
- In 2017, the most frequent hours for bike share usage by annual members remained the same as in 2016, with high usage between 7am and 9am, and between 6pm and 7pm. During this year, there is a noticeable usage by casual members and the most frequent hours were between 1am and 7pm. The most popular routes during these hours remained similar to those in previous years, with a focus on commuting and leisure destinations.
- In 2018, the most frequent hours for bike share usage by annual members remained the same as the two years before, with two peaks between 7am

and 9am, and between 6pm and 7pm . The most frequent hours for bike share usage by casual members remained also similar to those in 2017. The data suggests that the most frequent hours for bike share usage by annual members are more consistent over time, while the most frequent hours for casual members are more variable.

Overall, the data shows that the most frequent hours for bike share usage by annual members are more consistent over time, while the most frequent hours for casual members are more variable. This might be due to the different purposes for which annual and casual members are using bike share, with annual members using it primarily for commuting and casual members using it for a wider range of purposes. The data also suggests that the most frequent hours for bike share usage are influenced by factors such as commuting patterns and the availability of other transportation options.

Summary

In summary, this report compared the bike share data for Quarter 2 (Q2: April-June) in the years 2016, 2017, and 2018 in order to understand trends and patterns in bike share usage over time. The data showed that bike share usage differs between the weekdays and it seems that the use of bikes is higher during the working days(Monday-Friday) in comparison to the weekend.

In terms of geographical distribution and usage was higher in certain stations compared to others, which were placed in the city centre. Regarding the riders, casual riders are fewer than the riders with membership. However, casual riders used the bikes for a longer time than those with a membership. Also, it is important to note that there is a pattern in rentals per member type for these three years, regarding the hours of these rentals.

The main implications of this data are that bike share programs are popular and well-utilised in the city, and that there is potential to increase usage even further through targeted marketing and outreach efforts. The data also suggests that bike share programs are being used for leisure and recreational purposes in addition to commuting, and that there are certain events and neighbourhoods that are particularly conducive to bike share usage.

Given these findings, there is potential to increase bike share usage even further through targeted marketing and outreach efforts. This could involve increasing the availability of bike share stations in under-represented areas, promoting the benefits of bike share to potential users, and addressing any safety or infrastructure concerns. Further research could also be conducted to identify the specific factors that influence bike share usage and to develop strategies to increase usage among underrepresented groups, such as low-income communities. By understanding the patterns and trends in bike share usage, we can work to optimise the operations and impact of bike share programs in the city.