How equitable is Paris' Vélib bike-share scheme?

The Paris Vélib cycle hire system reflects the socio-economic disparities of the city explain Elise Baudon and Stefanie Wessner

The Vélib bike service in Paris, France is considered one of the most successful citywide bike-share programs to date. Although not the first of its kind, it is today the largest in scale with a vast presence throughout the city. From its launch in July of 2007, the third-generation bike-share system has doubled its stations and number of bikes from 10,648 bikes at 750 stations to nearly 20,600 bikes at 1,451 stations. For a surface area of approximately 105 square kilometers and a population of 2 million, this averages out to over 14 stations every square kilometer and a remarkable 20 bikes available for every 200 people.

Yet if these ratios are far superior to any other urban bike share programs, some questions remain regarding how equitable access to these bikes actually is. Paris, like many European cities, is known for its share of inequities amongst its different neighborhoods, with wealthier populations living nearest its geographic, cultural and economic center. In light of this, this project proposes to add to the current literature on this popular bike share program, by means of layering and manipulating data relating to the placement of stations, the number of bikes per station, and the social and economic realities of the areas in which they are located.

By layering the distribution of Vélib' bikes with Paris's 20 districts – or arrondissements – we will attempt to determine if beyond the seeming dense fabric of stations throughout the city, there remain any questions of equity with regards to access to this specific service for Parisians - and ultimately to public transportation as a whole.

Background on bike share

The very first urban bike-share program was implemented in 1998 in the city of Rennes in France. Today it operates with 25 stations and 200 bikes and approximately 5000 official users. This system is a publicly owned system, funded and operated by a private firm: Clear Channel, and most bike-share systems in place today operate in a similar joint public-private collaboration. The primary incentives for the funding and operating of such systems lies in advertising and marketing rights given to the private firm who takes on the contract.

Other key features shared by most of the urban biking systems are modular bike stations equipped with generally ergonomic and lightweight bikes with distinct city-branded design. Memberships vary from year long, monthly, weekly, and even daily in a few cities. Bikes can be retrieved with the swipe of a credit card at numbered docking points which use proprietary locking systems to ensure that each bike is securely stored once it has been returned.

The Vélib functions similarly to most existing bike share programs today, with a few minor specificities. Membership may only be purchased with a bankcard that contains a chip, thus limiting access to tourists, particularly from the United States. In addition, the account used must have a minimum amount of 500 Euros for membership to be approved, raising first questions of equity.

While the system has been very popularly received and lauded in the press, a fair amount of criticism of the system being restricted to the city limits has been taken into account plans are currently under way for expansion into the adjacent (less wealthy) suburbs.

Methodology

The process of analysis undertaken in this project is as follows: We begin with a spatial analysis of bike stations and bikes as they are distributed within the city. This leads us to the key issues we chose to evaluate: density of bikes, density of people and ultimately, the number of people per bike available in each of the twenty arrondissements.

From here, we establish four arrondissements which we will compare in terms of population age, income and access to public transportation. Finally, our findings lead us to the conclusion that while the Vélib bike system is not a blatantly inequitable system, it does not do enough, in our opinion, to mitigate the existing socio-economic disparities between arrondissements in Paris.

Technically, we proceeded first by downloading data and shapefiles from our primary sources: APUR (Atelier Parisien d'Urbanisme, and urban planning and design firm), the RATP (Régie Autonome de Transport Parisien, or Paris transit authority) and finally the INSEE (Institut National de la Statistique de des Etudes Economiques, or French government census agency). Next, we worked with reconfiguring and matching projections, manipulated symbology and queried data representation (points to polygons, links and normalization), created new data sets with population demographics and compiled, joined and related, clipped and isolated data layers

Limitations

Regarding data acquisition:

- Difficulty to access non-US data
- Non-disclosure of racial statistics and distribution in France
- Inability to access shapefiles on public transport (bike lanes, bus routes)

Regarding analysis:

- Arrondissements as units of analysis are large
- Equity in terms of access to the Vélib may be contingent on factors other than simply proximity to stations (such as possession of a credit card, incentives to bike, or average travel distances)

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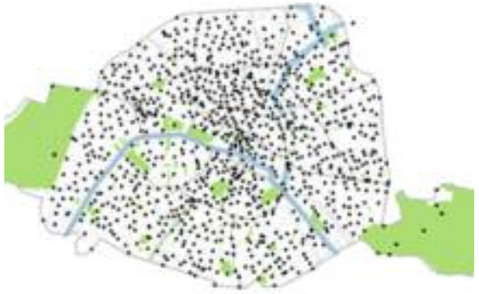
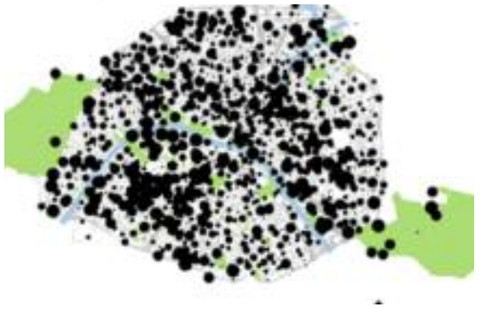
Elise Baudon and Stefanie Wessner carried out this study on the Geographic Information Systems Course at Columbia University

>>> The analysis involved mapping all the Vélib bike stations in Paris.
At first glance, the entire city seems to be quite well served by the system

map 1: We attribute values to each station according to the number of bikes they are designed to hold, we begin to perceive differences in density of bikes available:



map 2: From here, we represent the number of bikes by arrondissment to better illustrate their distribution throughout the city. This map indicates a strong concentration of bikes in the South – West arrondissements, with the central arrondissements having much fewer bikes available.



map 3: Yet this data means little on its own, given the disparity in area and population of each arrondissement. This following map of population density throughout the city, highlights the findings of the above map: where there are the most people per km2 (the North West) is not where we find the most number of bikes.

map 4: Merging these two maps enables us to look at number of people per bike. The following map confirms that more people share fewer bikes in North/East. It also highlights the disparities with number of people per bike ranging from 7 people per arrondissement all the way to 118 people.

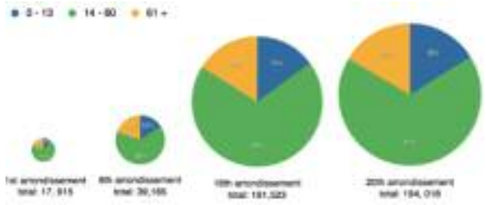
map 5: Given the nature of the program, we chose to refine the above map limiting the population to people over 14 (min. age to use the Vélib) and under age 60. The distribution is slightly changed:

map 6: This map allows us to isolate the top two and bottom two arrondissements in terms of number of people per bike, which we have chosen to focus on for a comparative study:

map 7: These arrondissements are the 1st, the 8th, the 18th and the 20th. As the graphic below shows, the population distribution of each of the arrondissements in terms of age is quite similar. However, we can see a critical difference in the population size.

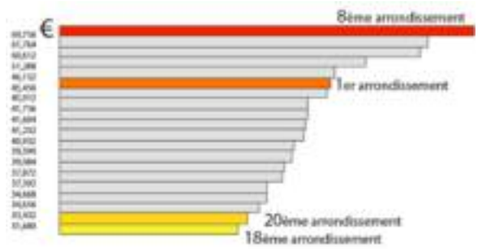
diagram 1: Even though, the 18th and 20th have a larger surface area, their population density (map 4) is still higher: less than 10,000 people per square kilometer in the 1st and 8th compared to 25-30,000 in the 18th and 20th.

If we compare average annual income in these arrondissements, we quickly see that the 1st and the 2nd, with a lower number of people per bike, also have a higher income than the 18th and the 20th . In fact, the 8th has an average income over double that of the 18th and the 20th each.



map 8: Moreover, this information is highlighted by the graph below indicating average income in each of the twenty arrondissement: One of our isolate arrondissement (the 8th has the highest average annual income in all of Paris, while the two arrondissements with the most amount of people per bike also happen to be the lowest income arrondissements in all of Paris.

graph 2 (next column): Finally, we decided to compare the Vélib system to existing public transportation in these four arrondissements. Below are the metro stations within the isolated areas, with all the metro lines which service the city of Paris.



map 9: At first glance, there appears to be a comparable number of stations.

map 10: In this map however, we found a higher density of metro stations in the arrondissements with the lowest population density and the fewest number of people per bike. Access to the Vélib mirrors the trends in access to the metro.

Conclusions and recommendations

Based on the comparative study of the four isolated arrondissements, our conclusions are these:

- The differences in number of stations and bikes in each of these arrondissements. mirrors their disparities in annual income and access to public transportations.
- Access to Vélib bikes is not equitable in that is does not lessen existing inequalities.

Based on these conclusions, as well as the citywide data that we represented in this project, we make the following conclusions for the city of Paris as a whole:

- The extent and density of the Vélib service across all of Paris is commendable.
- However, the core arrondissements in the centre have fewest people per bike while periphery arrondissements display a much higher ratio of people per bike.
- This difference reflects the same socio-economic disparities between the South-West and the North-East of the Paris.

With these findings in mind, our recommendations are based on the fact that we believe that the Vélib system has a greater potential of becoming an equalizing tool for socio-economic disparities in Paris:

- The Vélib's sparse distribution should be improved in the North-East arrondissements
- Now that the service is established in its popularity and its efficiency, the city should now focus on questions of equity and access to public transportation between arrondissements.
- These efforts should be combined with the current limited implementation of city bike lanes, to facilitate connections to and from as well as within periphery arrondissements.