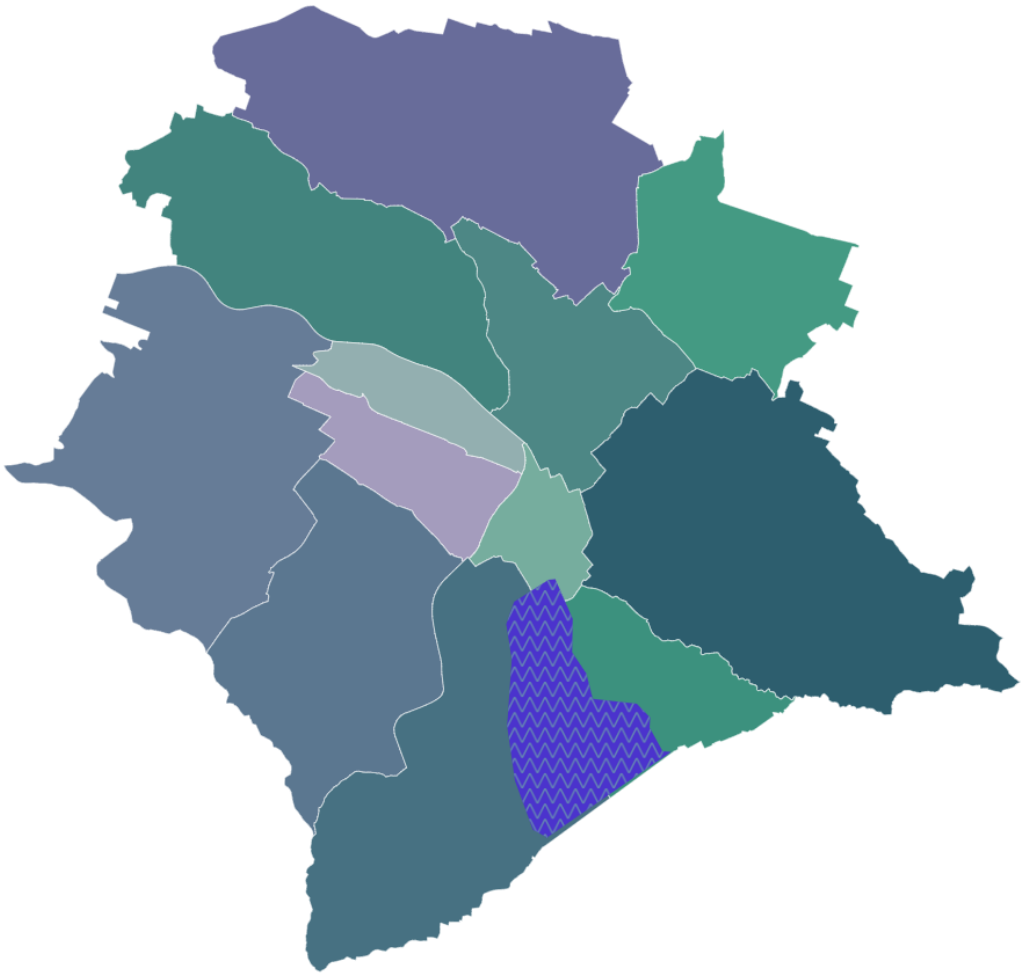
Parking Spaces of the City of Zurich



Context

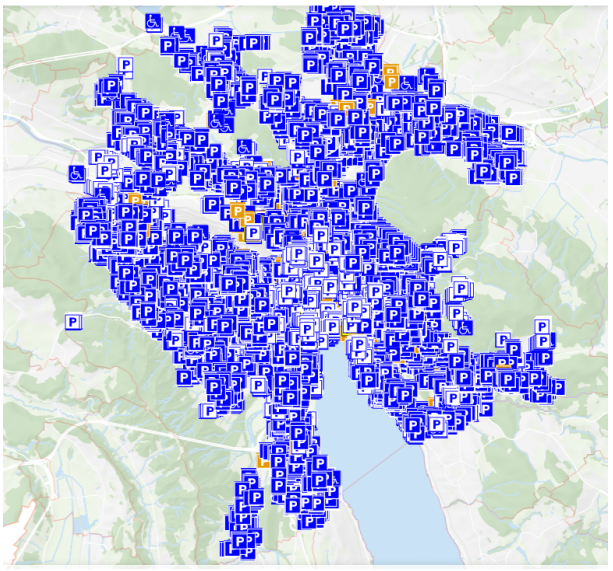
"Parkplatzkompromiss" - The Historical Compromise of 1996

In 1996 the municipal council adopted a compromise for Zurich City and areas close to the center. It essentially consists of making the city center more attractive for pedestrian traffic by shifting surface parking spaces to parking facilities, but without affecting the total number of publicly accessible parking spaces. The municipal council defined the 1990 level as the starting point. The number of parking spaces in the city center should remain stable at this level.

After 25 years it has come to an end. Here we compare the amount of parking spaces of cars to the parking spaces the city provides for bikes of any kind. We will explore the data along the temporal axis. We visualize how public car parking spaces have been moved, removed or replaced by parking spaces for bicycles or motorcycles over time. We analyzed the historical data and focused on the effects of the recent change in parking space laws in the city of Zurich. This visualization is expected to be of interest to people living in the city and will potentially show the results of the end of the *Parkplatzkompromiss*, a law aiming to keep the number of available car parking spaces in the inner city constant.

Path to the Visualization

Beginning



We started this project by looking through different possible datasets on *opendata.swiss*. While searching we found a lot of data about traffic, cars, EV charging stations... One team member then found the dataset for all parking spaces within the city districts of Zürich. This got us thinking that it would be interesting to compare it to the parking spaces the city provides for two-wheelers along the temporal axis. After discussing this idea we thought about the city compromise and that the number of parking spaces should theoretically stay the same over all districts but the bike parking might change quite a bit. The figure shows the map of the city of Zurich with all car parking spaces from 2021. We quickly realized that displaying every parking space is not that useful as it is simply a big cluster of points. Those were the ideas we explored in Milestone1.

Data Processing

The files provided by the city of Zurich that we found online were very complete and easy to use. They had already created a GeoJson with coordinates for the parking spaces, there was a GeoJson for the polygons of the districts and other information about them. But the city only provides the data of the most recent data of the parking spaces that they collected. So we contacted the city's department that is responsible for this collection directly via Email and had a few calls with them to inquire about older data.

Luckily these files exist, they are simply not directly available online. So we were able to get the data. As it turns out, data collection is done every

second year and the data for car parkings dates back to 2011 while they started collecting data of bike parking spaces in 2017. We now had some incomplete data. In order to fix this we simply linearly interpolated the data. This way we can display the parking spaces of even years and compare two-wheelers to cars before 20217.

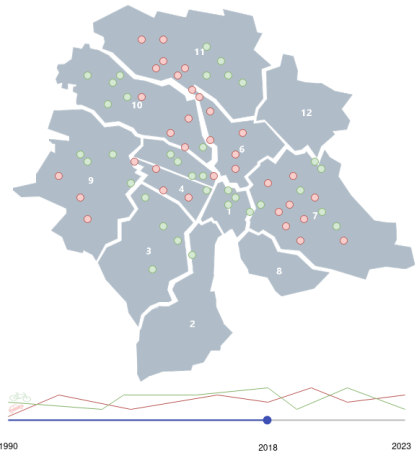
The data we received from the city of Zurich was in the *Shapefile* format. Coordinates in Shapefiles are expressed relative to a Coordinate Reference System (CRS). As is common for Switzerland, it used the CRS *EPSG 2056*. In order to use this data with d3, we needed to convert it into *WGS84*, which is a global coordinate system. This conversion was done using the python package *geopandas*, which can be used to manipulate geospatial data. We also used geopandas to compute which district a certain point (i.e. parking space) belongs to. This is known as the non-trivial *Point in Polygon* problem. It was necessary to do this processing locally beforehand instead of on the server, as it took multiple minutes to calculate district membership for the thousands of parking spaces across all the years.

Sketches and Planning

In Milestone 2 we further developed our ideas. We realized early on that displaying data on a map with a temporal component is going to be quite difficult. In order to achieve this we decided that having a slider as the temporal axis will be necessary to reduce the complexity. The selected year will then be reflected on the actual graphs that we draw. This allows us to have two dimensional graphs with an extra z-axis. In the following we show the different sketches that we created.

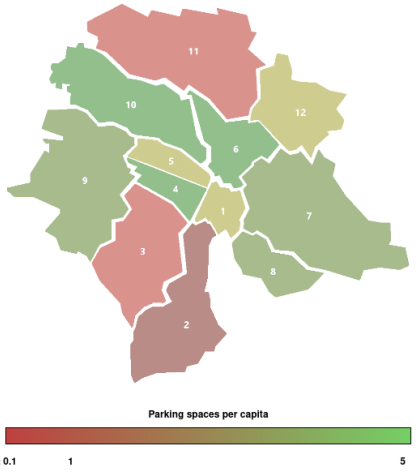
All Points

We then started creating different sketches. In figure 2 we see the most "direct" approach to display the parking spaces, i.e. per registered space add a point on the map. Distinguish the cars and bikes parking spaces by color. We built this view for Milestone 2 with only the cars.



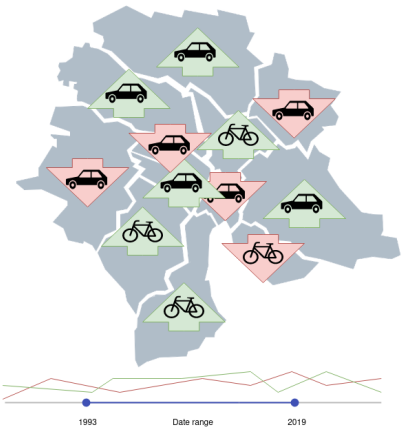
The biggest challenge with this visualization is the amount of data. There are too many points (as seen in Figure in Beginning) and its performance is also really bad. We looked at solutions for better performance (such as using Quadtrees or similar) but ultimately decided against using this visualization due to the challenges and reasons above.

Parking Spaces per Capita



Different districts have different amounts of people living in them. Comparing them to the number of parking spaces seems like a good idea, as more people need more space for living but also mobility. So we sketched parking spaces per capita. While we liked the approach of combining the data with other variables, we are not directly comparing the different parking spaces to each other but rather the spaces per capita. The implementation of this sketch was on the optional list but due to time constraints was not implemented.

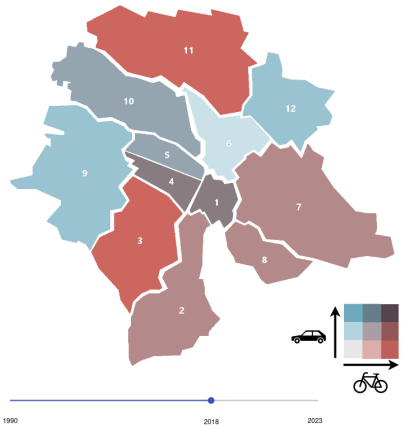
Change over time



In the next sketch we wanted to highlight the changes in the number of parking spaces between two dates. For each district we would indicate if the amount of parking spaces for the respective type grew bigger or shrunk down. A cluttered map was the limitation we faced here when implementing the first version. We thought of possible solutions but decided against pursuing them further as we had other visualizations that would cover a similar case.

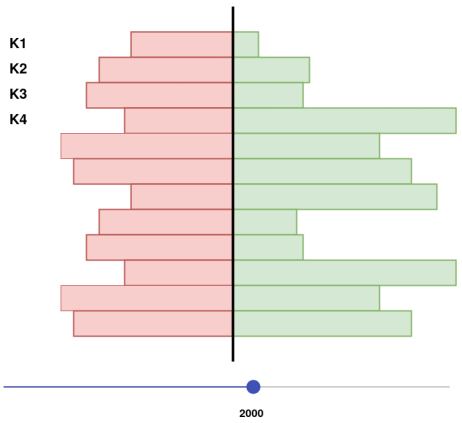
Bivariate 2-dimensional Color Palette

This visualization was the most interesting sketch that we came up with. It moves away from the exact number of parking spaces and compares the parkings for bikes and cars relative to each other. Further it is also able to show how many parking spaces there were compared to different districts. Using a good palette we are able to create a nice visualization. Adding a slider for the temporal axis, one can easily compare the development of the parking spaces.



Snapshot in Time per District

Our last sketch compares the actual values of parking spaces of each district. It is easy to see the concrete values between each district and, within each district, the numbers of bikes and car parking spaces. We took inspiration from population pyramid graphs to display it in such a way. Again a slider represents the temporal axis.



Challenges

One of the challenges in our project was which framework we should use for the website around the visualization. Every team member had at least some experience with web development, however there was no framework which the entire team had prior knowledge of. We ended up going for the React framework.

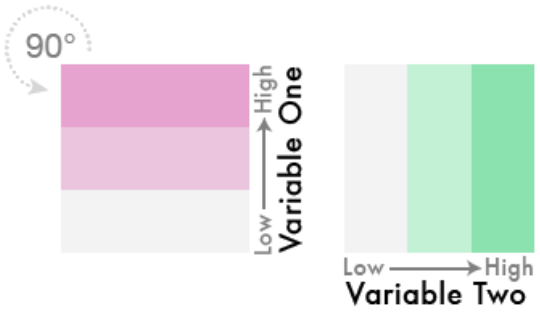
Next, nobody had any experience with d3 or other similar visualization tools. Figuring out how to implement our sketches turned out to be more time-consuming than we initially anticipated, even though there are many tutorials available online. Further the performance when using a lot of data

requires extra care as it can render the website unusable. This came to the detriment of the amount of visualizations we were able to create.

Another challenge was the acquisition of the actual data. While an employee of the Tiefbauamt Zürich (TBA) assured us that they would supply us with the data, it was still a time consuming and long process until we finally had the historic data we wanted. Except for the fact that there was, in contrast to what we were told at first, no data for bicycle parking spots before 2017. This meant that half of our timeline only has data about car parking spaces available.

This meant that we were not in possession of as much data as we had hoped for. Combined with the fact that parking spaces in Zürich do not change that often, there were also not that many interesting changes to show. If we were to do this project again, we would opt for a dataset that we can fully examine beforehand instead of relying on getting additional data later.
To partially combat the resulting low volume of information, we added a tooltip that shows up when hovering above a district with some general information about the district.

An interesting challenge was the creation of the bivariate color palette, which combines two gradients of more or less complementary colors. The gradients are blended together, which allows us to display the value of two variables with a single color. (Image taken from joshuastevens.net)



Final Results

In the end we created a compact website that runs smoothly. The decision to focus on the few visualizations we created was a good idea as we were able to make them as polished as possible by adding for example animations

to increase the overall user experience of the website. Further displaying all parking spaces is already available online and did not add anything useful. So instead we decided to highlight the change of parking spaces of cars and bikes in relation to each other.

Additionally we changed up and combined some of our initial sketches. For example we added the parking spaces as a graph to the slider in the bivariate color palette visualization.

Peer Assessment

Damiano	Josua	Silas
• Website Structure • CI Pipeline and Deployment • Report Writing • General bug fixing and improvements	• Sketches • Website Structure • Data collection and processing • Report Writing • General bug fixing and improvements	• "Bivariate 2D color palette" visualization • "Snapshot in Time per District" visualization • Report Writing • General bug fixing and improvements