Switzograms

An Isochrone Map of Switzerland's Public Transportation Network

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Introduction

Our project aims to provide enriched visualizations of the contrast between **spatial** and **temporal** distance in Switzerland as well as the **population**.

We split the country into equal-sized hexagonal tiles and generate **isochrone maps** using any given tile as its starting point. This will allow the user to better understand its mobility potential, and restructure its thinking based on temporal and spatial information.

Available Data

We have at our disposal the **GTFS** data provided by gtfs.geops.ch, **geospatial data** from opendata.swiss.ch and **population** information from the Federal Statistical Office website https://www.bfs.admin.ch.

The GTFS data contains all the transit information of the public transport network of Switzerland. We focused our attention on the schedule data since they provide a way to estimate the time distance between the nodes.

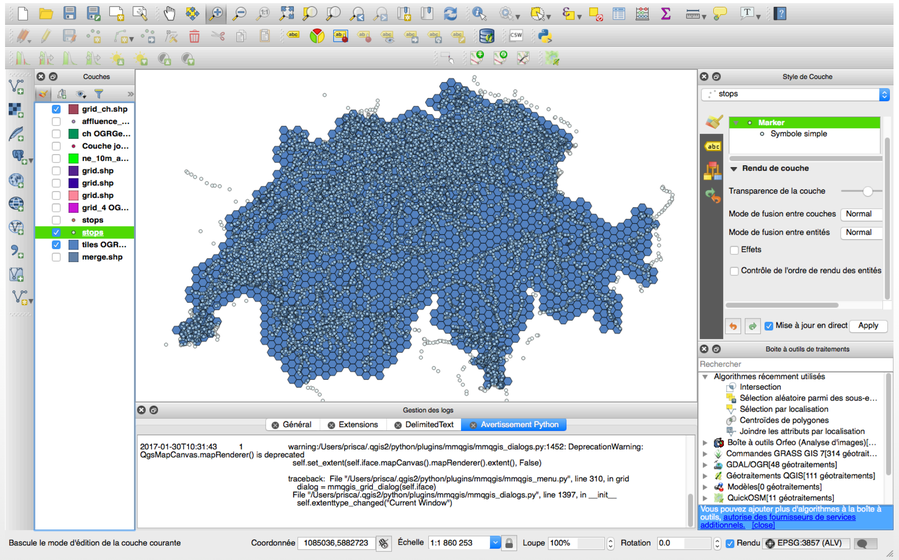
Representative Nodes

One of the challenges encountered is that a tile contains many nodes. Our tiled map requires a specification for the computation of distance between two tiles. This was achieved by nominating a representative for a given tile to act as its source and target. Of course, the remaining nodes of the tile are still present for the travel computation but only as intermediary steps.

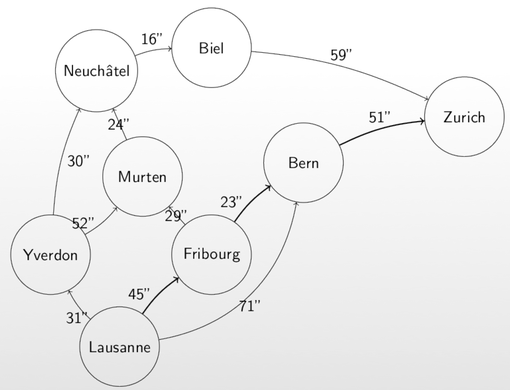
The most relevant representative is the **biggest "hub"** of the tile (high-traffic, high-speed travel). Slower modes of transportation branch out from this hub. This hub is identified by selecting the node with the highest average daily affluence (when available), otherwise the highest degree of connections amongst all nodes in the tile, when connecting with a subset of nodes of the whole network (important and less important train stations).

Hexagonal Map

We combine the map of Switzerland and the transport nodes into a simplified hexagonal map using **QGIS**, a great software to create and edit geospatial information.



Simplified subgraph Lausanne-Zürich trip



Visualization

We use **Three.js** to display the hexagonal map, a JavaScript 3D graphics framework built on top of **WebGL**.

The hexagons' centers are generated with QGIS and their height represents the population.

We offer the possibility to add and remove **cities** from the map through an interactive search bar.

Time Distance Computation

We pre-compute the matrix representing the time distance from every tile to every tile.

To fill this matrix, we create a weighted directed graph of the public transport nodes of Switzerland.

As explained in the previous section, the time distance between the nodes can be approximated from the GTS schedule data. The weights of the edge of the graph are calculated using the average daily lapse of time of getting from one node to the next.

Once the graph is obtained, the multipoint **Dijkstra** algorithm is used to compute the time distance from every representant to every representant.

The matrix for the total number of nodes is intractable, but the matrix for the representant is more reasonable: as large as the square of the number of tiles, i.e. approx. 1600x1600.

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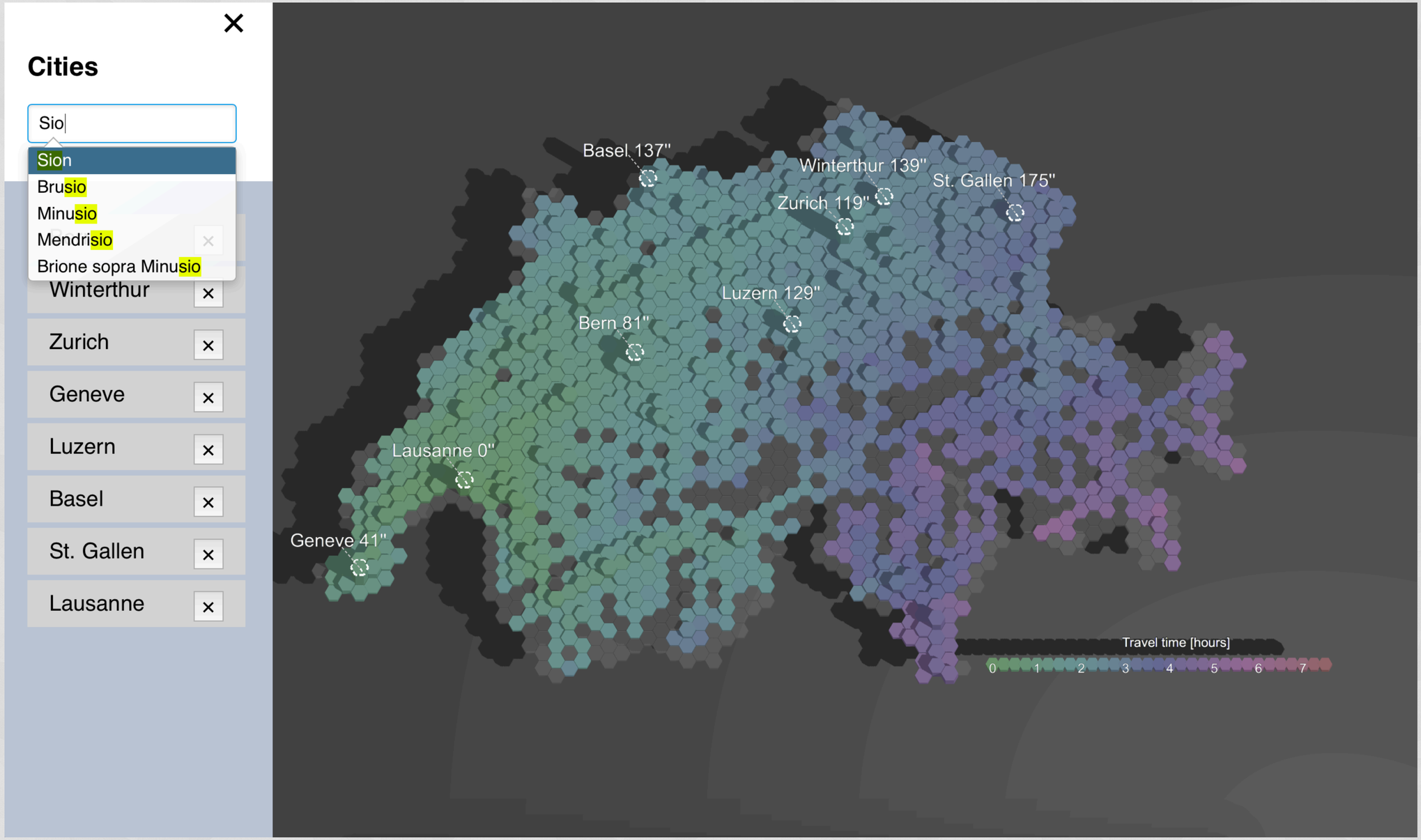
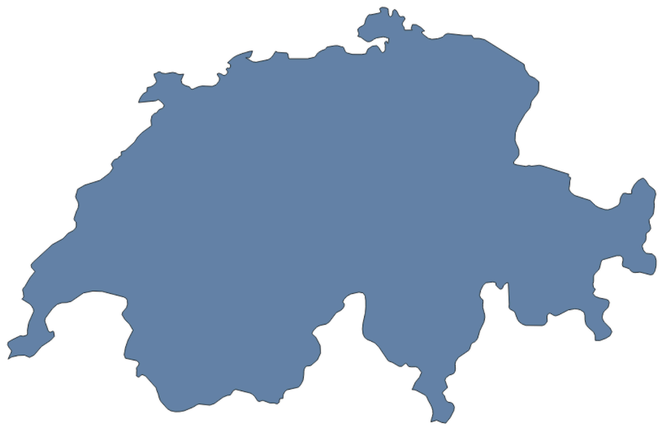
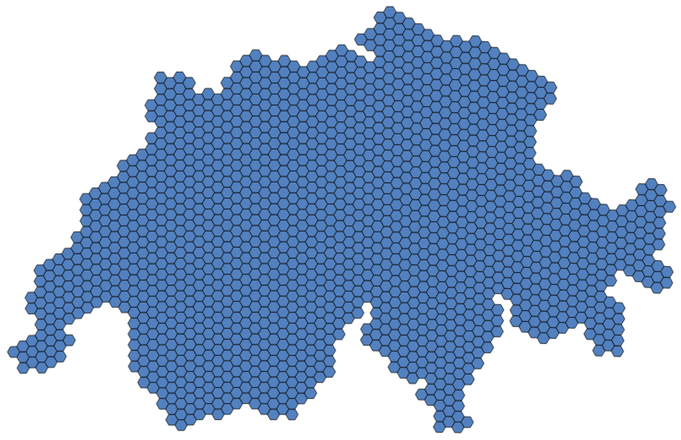
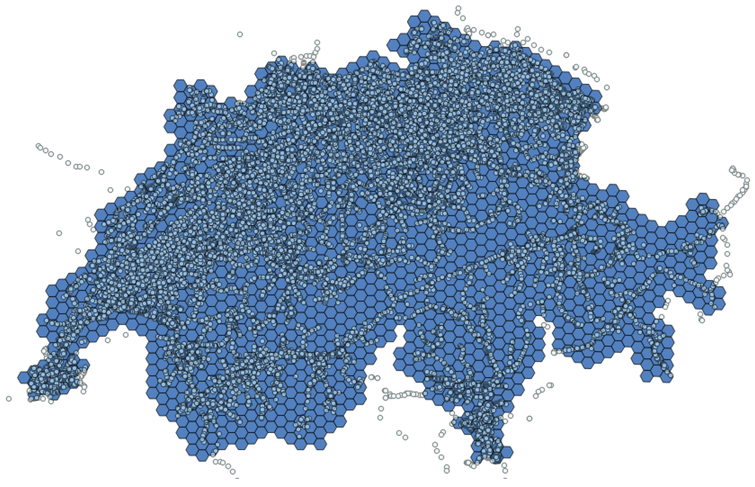
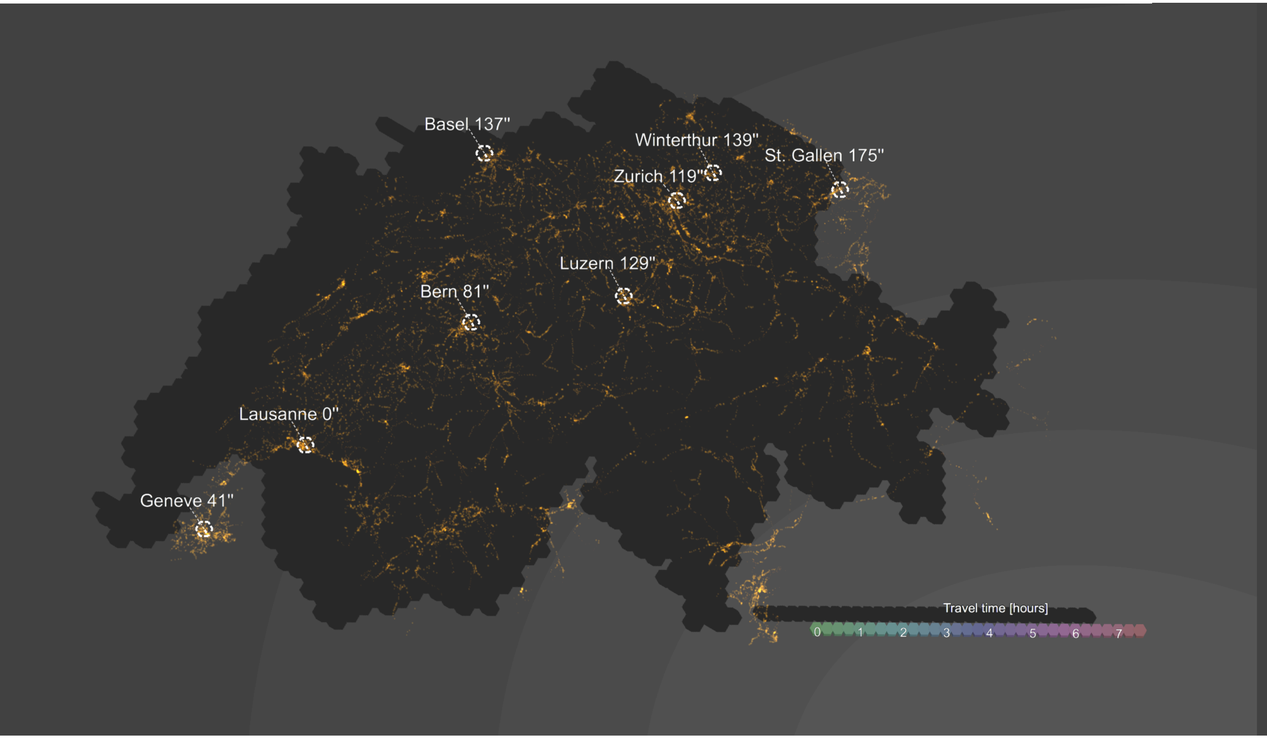
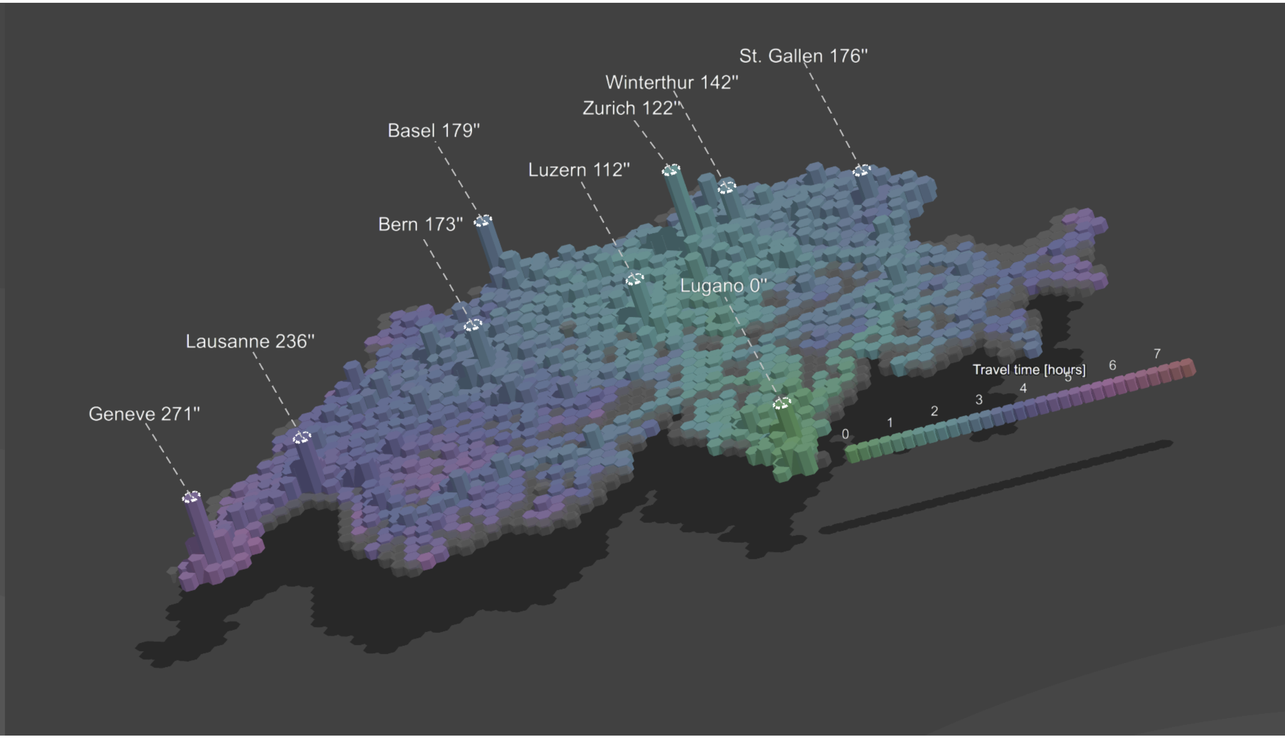









Basel 137"
Winterthur 139"
St. Gallen 175"
Zurich 119"
Luzern 129"
Bern 81"
Lausanne 0"
Geneve 41"
Travel time [hours]
0 1 2 3 4 5 6 7


St. Gallen 176"
Winterthur 142"
Zurich 122"
Basel 179"
Luzern 112"
Bern 173"
Lugano 0"
Lausanne 236"
Geneve 271"
Travel time [hours]
0 1 2 3 4 5 6 7