

# UrbanMobility

## Evaluation of mobility indicator visualizations in interactive 3D environments

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### 1 Introduction

This work tackles the challenge of finding possible visualization techniques for mobility metrics in 3D and investigates their suitability and performance. Additionally, the resulting 3D symbolizations are compared to a similar 2D approach and the difference in performance and experience is measured.

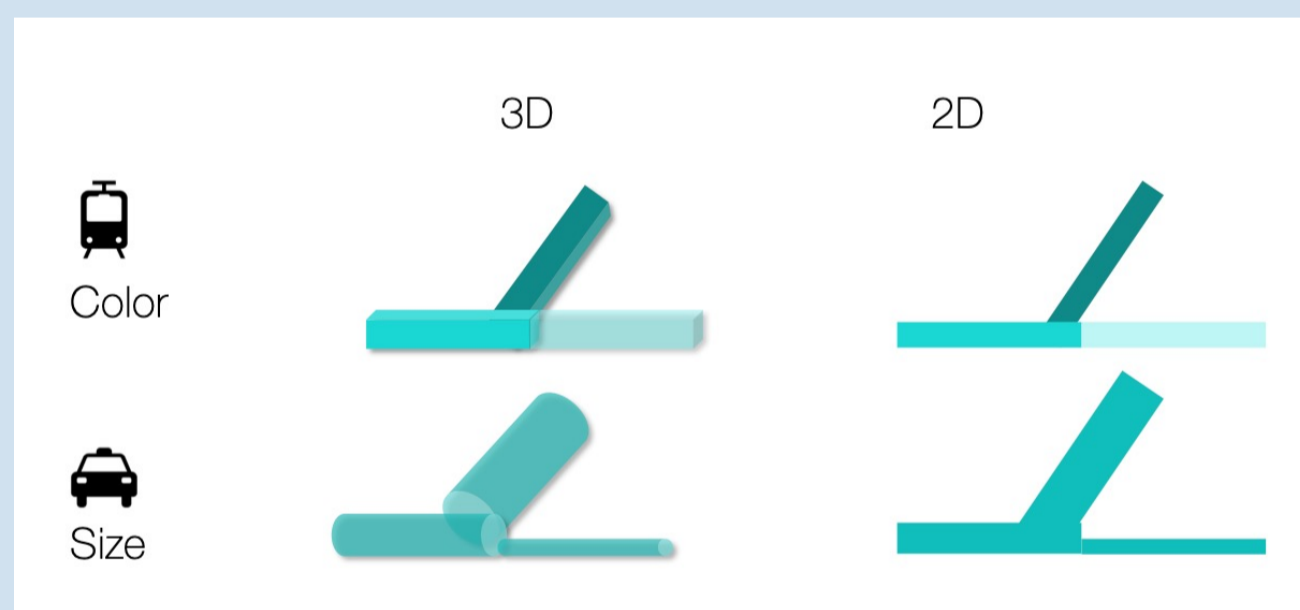
### 2 Methodology

The use case defined for this thesis is a web-based application for the Rosengartentunnel project, a major mobility undertaking in the city of Zurich and the subject of a recent public vote. The vision is to build a platform where citizens can inform themselves and form an educated opinion.

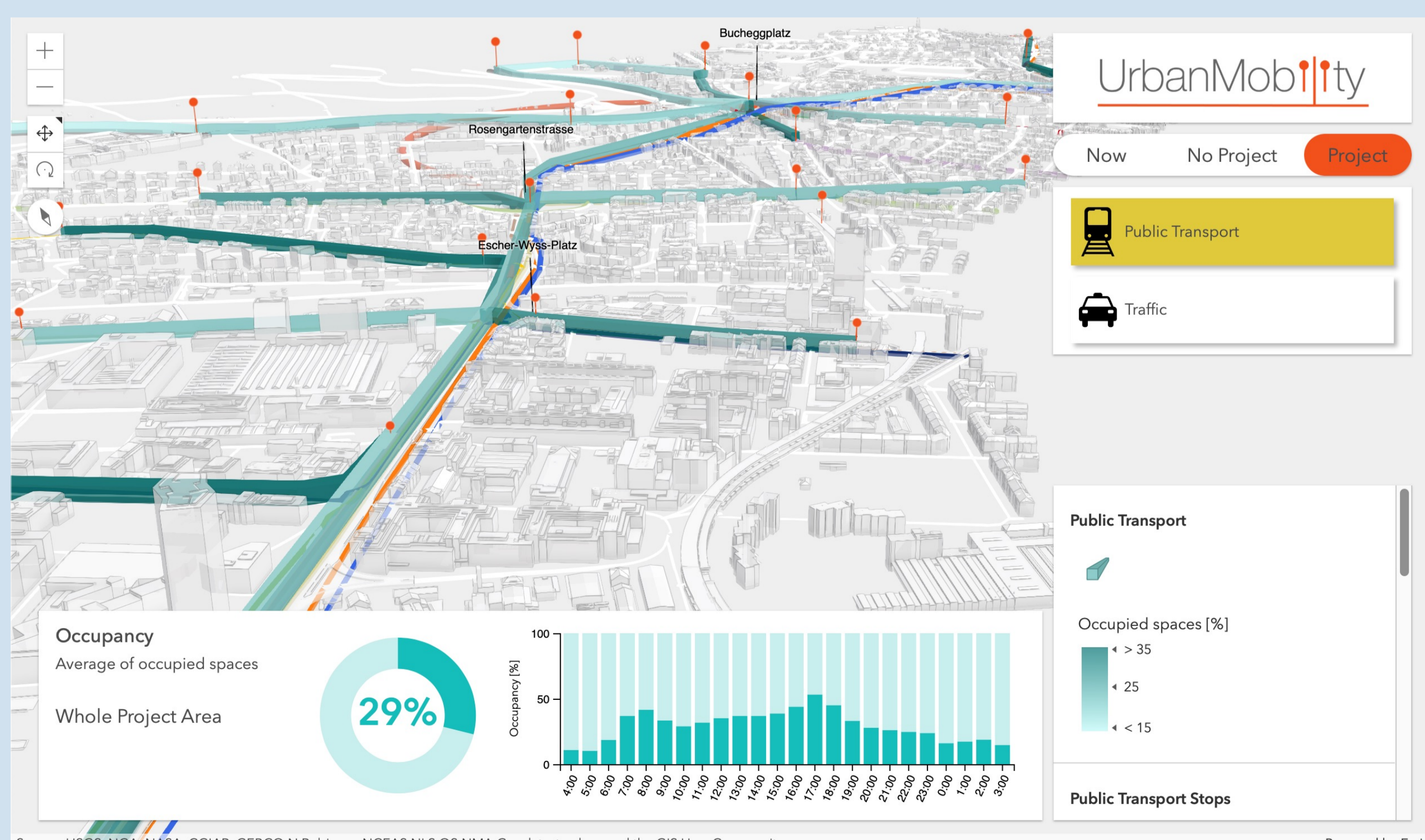


The result is the application *UrbanMobility*. There are two themes, Public Transport and Traffic. The data which is visualized is the number of passengers in public transport and the amount of cars on the road.

The app was built in two different versions (2D and 3D) and contains two different visualization techniques for mobility flow data, either using the visual variable color or size.



The prototype was then tested in the form of a within-subject user study with 83 participants. The study had two main goals: Compare the visual variables color vs. size and the two versions 2D vs. 3D. The study was designed to be conducted online without external supervision. The users had tasks to find specific pieces of information with the help of the application.



This is the graphical interface of *UrbanMobility*. On the top left you can switch between the different modes and themes and on the bottom, there is a dashboard with additional data like hourly data about mobility flow.

### 4 Results and Discussion

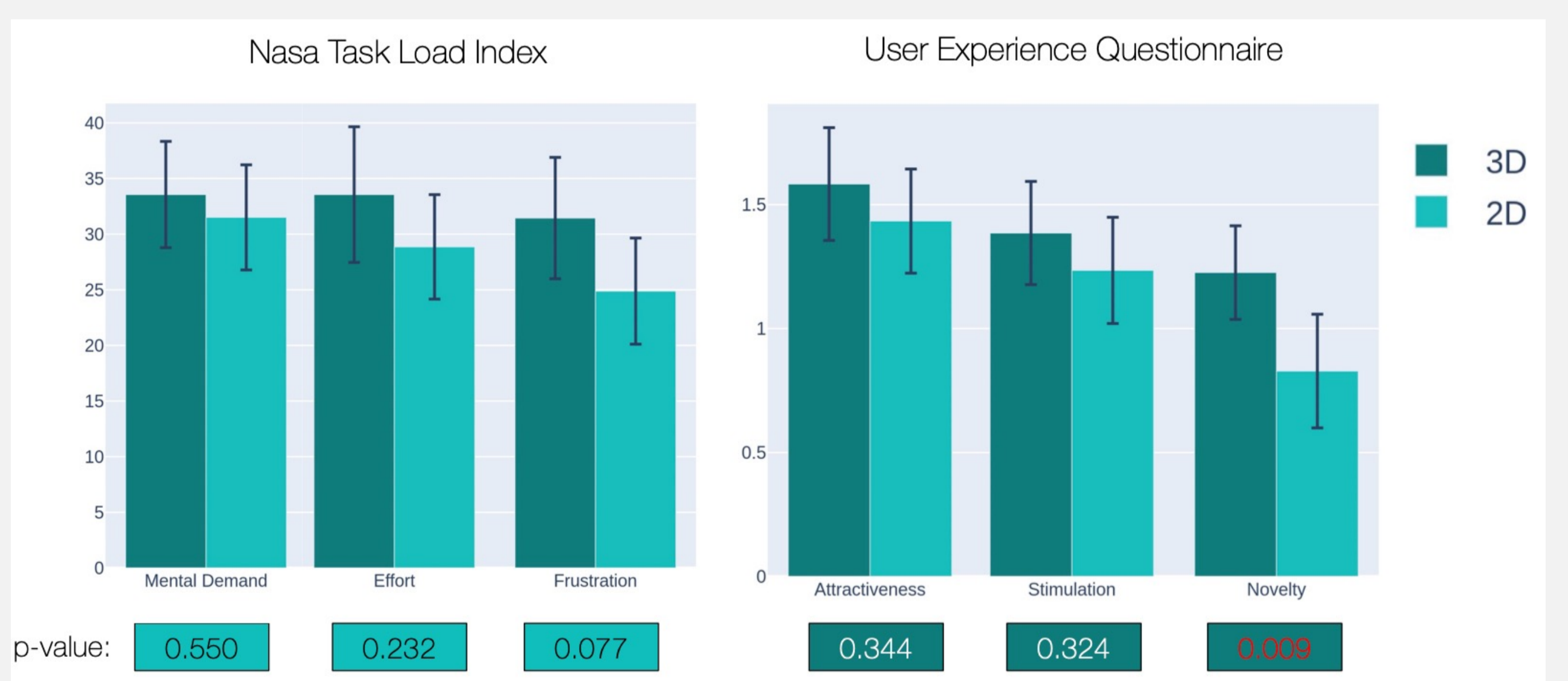
The study yielded several interesting results. When comparing the two visual variables color and size, size always outperformed color. The difference was even more significant in the 2D version.



Left: We can see that size has a higher success rate and the users need less time to complete the tasks. Right: The 2D and the 3D version perform very similar, there is no significant difference to be seen. Note: If the p-value (in the boxes) is lower than 0.05, the difference can be considered a statistically significant.

When comparing 2D vs. 3D, a major discovery is that objective measures like success rate or task completion time do not indicate a significant difference

Nevertheless, the subjective experience differs between the two versions: The users found the 3D version more attractive and stimulating, but also stated that it is more demanding to operate. This could be because most existing map services are in 2D. When users will be more used to 3D maps, the mental demand might decrease and 3D could be the altogether better version.



The users experienced that the 3D version has higher mental demand, needs more effort and made them more frustrated. But nevertheless, they rated it more attractive more stimulating and much more innovative (with a statistically significant difference).

### 5 Conclusion

- The users found the 3D version more overwhelming but deemed it more attractive and stimulating. However, the performance shows no significant difference.
- Symbolization with size yields better performance than color.

### References

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- Source data by Open Data Zurich and OpenData Swiss