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Building Facade Colors for Urban Navigation

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Abstract:

The chromatic diversity of building facades is induced by the history of the neighborhoods. This diversity reflects areas' unique characteristics. However, in traditional 2D maps, buildings are typically represented solely by their shapes, and in some cases, only a few constructions are depicted in detail as landmarks. This conventional approach often overlooks the rich visual information conveyed by the colors of building facades.

This work focuses on constructing a representation of building facade colors on a 2D map and investigating the relevance of this representation for navigation in an urban area. A comprehensive literature overview suggests that the topic has never been properly explored in cartography. Although the chromatic aspects of building facades have been examined in geo-based research (Zhai et al., 2023), integrating such data into navigational maps remains relatively uncharted territory. Numerous studies have addressed building facade color data acquisition in urban color mapping, notably using street-level imagery (Zhang et al., 2021; Zhong et al., 2021), where the dominant colors of buildings are automatically extracted. Additionally, landmarks play a crucial role in wayfinding, significantly enhancing navigational efficiency and accuracy by providing recognizable and memorable visual cues in real and virtual environments (Yesiltepe et al., 2021). Integrating color information into maps can enhance these benefits by offering a layer of visual distinction.

In one notable study, Kapaj et al. (2022) explored how different levels of abstraction in 3D building representations on maps affect navigation memory and performance when following a given route. This work inspired the current study, which focuses on a part of Ottakring, Vienna, as the selected study area. The new map design relies on building facade color data collected from Google Street View (GSV). For simplicity and clarity, only one color is assigned per building. To reduce cognitive load, a color generalization algorithm was developed to adjust the number of colors displayed according to the zoom level. This algorithm groups buildings with similar colors and assigns them an average color, achieved by projecting the colors into the perception-friendly CIELab color space and using the MeanShift clustering algorithm.

Figure 1. Color generalization of building blocks. From left to right: all colors, 6 colors, 2 colors.

To evaluate the effectiveness of the new map design for navigation tasks, an online user testing platform embedding Google Street View (GSV) was created. Participants are asked to follow a path shown on either the map with colored buildings or a map with only grey buildings. Their movements within GSV are tracked, and they answer questions after each navigation task. Using GSV as a virtual environment provides a controlled setting that is easily accessible to many participants, as it only requires a computer and internet access.

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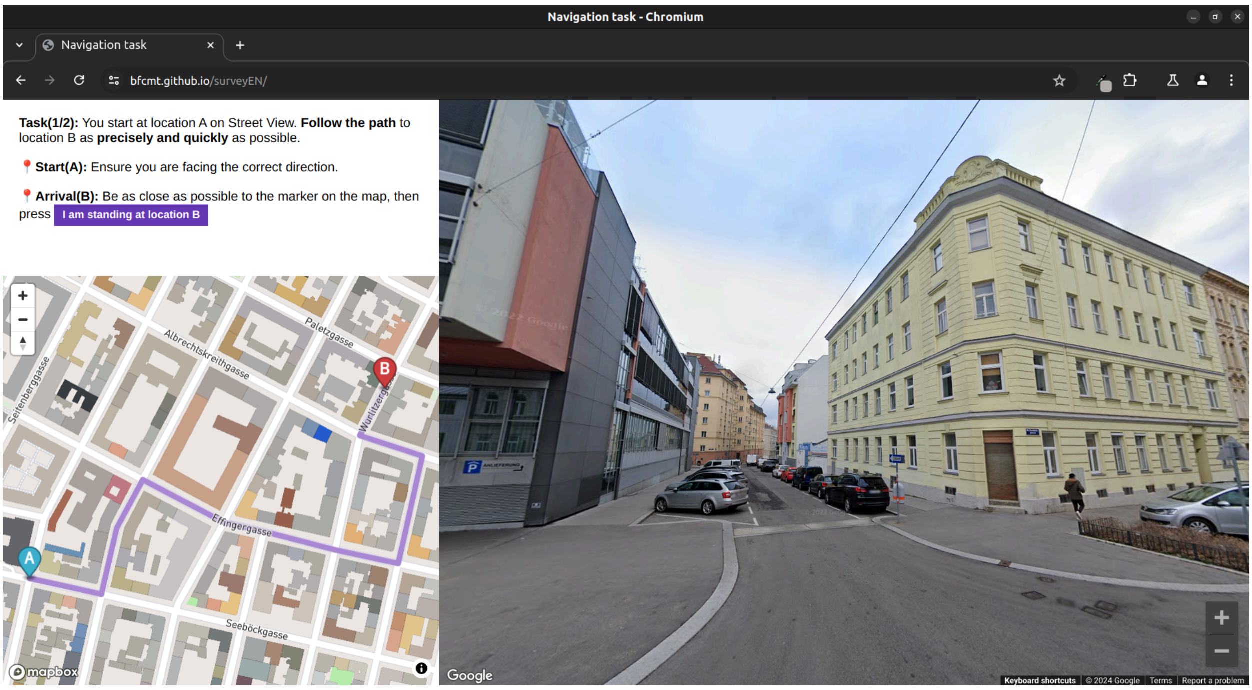

Figure 2. User testing platform, navigation task 1, color map.

The study aims to recruit 100 participants for the survey. The results will analyze participants' confidence levels during navigation tasks based on the answers and the ratio of successfully accomplished tasks on both maps while considering the potential learning effects based on the tracking. Additionally, the study will consider participants' feedback on the usability and helpfulness of the colored building facades in aiding navigation. By incorporating these elements, the research seeks to determine whether adding chromatic information to 2D maps can enhance navigational efficiency and user satisfaction.

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