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Fill the map: Integrating objective data and citizen knowledge for Participatory Urban Planning

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Abstract:

Throughout history, maps have served as indispensable tools for urban planners to comprehend the complexities of cities, spanning spatial, temporal, social, and material dimensions (Arieff, 2014). Initially utilized for practical purposes in organizing urban spaces, maps evolved into instruments for statistical analysis by the 18th century (Vaughan, 2018). This transformation marked a shift from geographic mapping towards exploring urban realities through statistical representation. The 18th and 19th centuries witnessed a burgeoning interest in mapping statistics, notably applied to studying pandemics and social issues like crime and poverty (Friendly et al., 2001; Vaughan, 2018). By the early 20th century, mapping saw a period of dormancy amid the rise of formal models in the social sciences (Friendly and D.J. Denis, 2001). However, the 1950s heralded participatory urban planning, emphasizing community involvement in the planning process (Guldi, 2017). Participatory cartography emerged as a pivotal aspect, integrating qualitative community insights into spatial representations (Denwood, 2022). This approach democratized mapping, bridging the gap between experts and communities. In the 21st century, the advent of smart cities ushered in a new era of digitally integrated urban spaces, revolutionizing cartography and fostering collaborative urban data analysis (Ratti & Claudel, 2016). Today, both static and interactive maps play vital roles in participatory urban planning, facilitating communication among diverse stakeholders and fostering a common visual language (Sauter et al., 2021).

The cartographic visualization of urban data is a powerful tool for decision-making processes in participatory urban planning. In these processes, visualizations should enable stakeholders to explore, create hypotheses, make sense of, and interpret patterns in the data. A comprehensive understanding of the urban environment requires the integration of objective data and citizen knowledge data. While objective data reveals patterns, citizen knowledge provides valuable insights from residents' experiences. Relying on either source alone can lead to an incomplete understanding. Effective participatory urban planning involves combining these types of data to ensure that community voices are considered, to contextualize objective data, and to identify data gaps. This integration leads to more equitable and people-centered decision-making processes. However, a significant challenge remains: designing visualizations that enable both stakeholders with expertise (technical experts such as urban planners, geographers, and architects) and those without (neighborhood experts, such as residents) to effectively make connections between layers and interpret patterns in urban data to enhance decision-making processes. effectively visualizing integrated objective data and citizen knowledge is a promising way to improve our understanding of complex urban environments. The complexity of urban data requires a thoughtful and balanced approach to visualization, where the right choice of visual variables, design elements, and generalization techniques play a critical role. These techniques must work harmoniously to enable meaningful analysis and informed decision-making, ensuring that essential insights are not lost in the pursuit of clarity.

This study aimed to identify optimal cartographic visualization strategies that combine objective data and citizen knowledge, thereby serving as decision-making tools within the framework of participatory urban planning. The research focused on comparing the understanding and preferences among diverse stakeholders of different urban visualizations, merging the two data types to achieve this goal. These visualizations included varying complexity, granularity, and generalization levels. A methodology using good practices as references was developed for creating the visualizations. The Lichtental Superblock project in Vienna served as the case study, and the evaluation process involved technical experts and residents.

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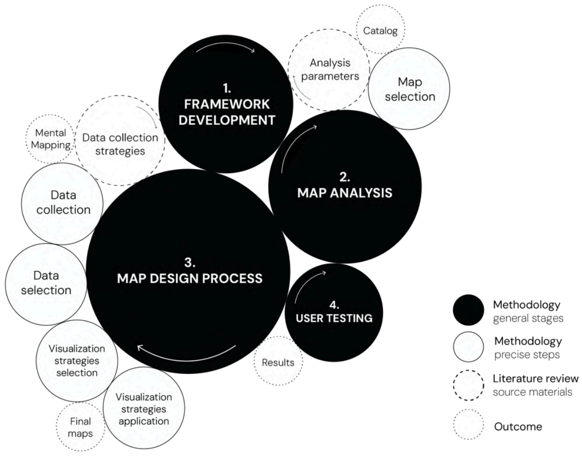

Figure 1: Graph representing the methodology used in the research.

This thesis had three main outcomes. Firstly, a catalog including a structured compilation of visualization strategies, providing valuable references to streamline the process and avoid potential errors in representation. Secondly, a workflow to visualize citizen knowledge and objective data together.

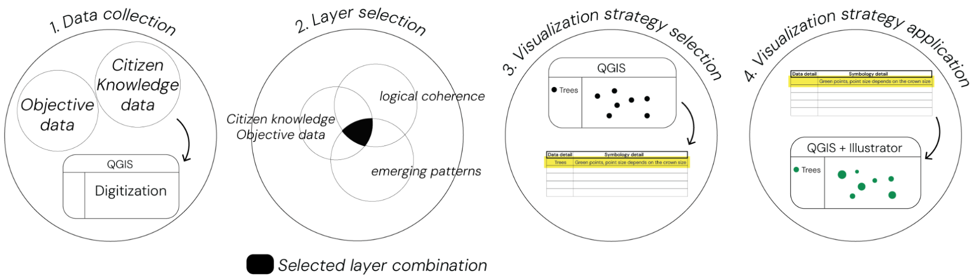

Figure 2: Graph of the four steps within the Map design process stage

Thirdly, a comprehensive set of recommendations based on the analysis of the case study results. These recommendations include general guidelines for creating urban data visualizations depending on their complexity level, aiming to increase the visualizations' effectiveness in the context of participatory urban planning. The study showed that the complexity of the visualization (see Figure 3) influences the pattern interpretation and map preferences among stakeholders with different levels of expertise. Low complexity maps showed that fine granularity representation was more effective for supporting decision-making due to its balance between accuracy maximization and minimal effort. On the other hand, medium complexity maps delivered more complex results. Stakeholders with expertise showcased a higher ability to identify connections in complex maps. However, those without expertise achieved comparable results when provided with hints. This emphasizes the importance of considering users' needs to provide adaptable solutions to improve their understanding of visualizations. In terms of preferences, the fine-granularity map was favored by both groups regarding accuracy, but the generalized map was chosen regarding ease of interpretation.

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Figure 3: Graph describing the generated visualizations.

This research opens possible directions for future research, including the possibility to test a broader range of case studies to increase the reliability and applicability of the results, the practical implementation of the visualizations as effective dialogue tools in participatory planning processes, and the implementation of interactivity in the visualizations to accommodate a variety of data layers and provide users with greater freedom to explore and interact with urban data.

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