

Tailoring Base Maps: A Study on Air Quality Maps

Ulrike Holfeld^{a,*}

^a Vienna University of Technology, Austria - e12237890@student.tuwien.ac.at

* Corresponding author

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Abstract:

With the emergence of digital mapping, the field of cartography has undergone significant changes. Further, the introduction of Google Maps in 2005 changed how maps are utilized and distributed. The accessibility of APIs has simplified map creation, allowing cartographers and non-experts to generate maps by overlaying datasets onto available base maps. However, this convenience has also led to challenges. Maps produced by non-cartographers often lack quality due to missing specialized expertise. One problem is the utilization of existing base maps, which are not tailored to specific purposes. This underscores the importance of selecting a suitable base map to facilitate effective communication of thematic information (Muhlenhaus, 2013).

Despite the critical role of base map design in thematic map interpretation, existing literature, such as Dent et al. (2009), predominantly addressed the visualization of thematic data, neglecting detailed discussions on base map design. Consequently, a research gap exists in understanding how to effectively tailor base maps to thematic map themes. It motivates a deeper exploration of base map design and methodologies.

The study's focus is directed toward the topic of air quality as it impacts various facets, including the economy, climate, and public health. With approximately 7 million annual deaths attributed to air pollution, it is a serious global concern (UNEP, 2024). Therefore, the United Nations addressed air quality in the Sustainable Development Goals (SDGs), explicitly goals 3 and 11, emphasizing the health and well-being of all humans as well as sustainable urban development (UN General Assembly, 2015).

Addressing the research gap, the objective of this study is to investigate the effectiveness of a tailored base map design to enhance the interpretation of thematic maps, particularly those related to air quality. First, existing principles for designing a base map will be identified. This includes the appearance of base maps, interactive features, and base map content. Second, a base map will be developed for a specific thematic dataset about air quality that meets selected design requirements. Finally, the effectiveness of supporting the understanding of the map will be assessed by comparing the created base map to a general-purpose base map through user testing.

The methodological approach involves a comprehensive literature review to understand design principles for digital base maps, drawing insights from thematic cartography and web mapping. Factors influencing air quality and their implications for base map design will be explored, specifically regarding the content of the base map. This step is followed by the comparison of existing general-purpose base maps to obtain characteristics of widely used ones. The base map will then be developed, considering findings from the literature and base map review, with a transparent documentation of design decisions. In order to choose a suitable method, available tools to create the base map, such as vector tile styling tools, will be evaluated.

Subsequently, an online survey will be conducted to assess the users' understanding of the map. Two maps will be tested: One map uses the developed base map, the other a general-purpose base map, both with the same thematic information for an adequate comparison. By asking participants to solve map comprehension tasks, this user testing method will allow the evaluation of the users' ability to interpret thematic information, providing valuable insights into the base map's effectiveness. A final refinement based on user feedback will optimize the base map to align with the research objective.

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