

Tailoring Base Maps: A Study on Air Quality Maps



by **ULRIKE HOLFELD**

With the ease of creating maps using APIs, many maps are now made by non-experts, often resulting in lower-quality maps. A major problem is the use of general-purpose base maps when creating thematic maps, which are usually not suitable for the map's purpose. Although the importance of tailoring base maps to the thematic content has been recognized in the literature [1,2], there is only a brief discussion about base map design and a lack of empirical testing. Addressing this research gap, the study contributes to the field of research by developing a customized base map for mapping air quality data.

RESEARCH OBJECTIVES

To investigate the effectiveness of a tailored base map design to enhance the interpretation of thematic maps about air quality.

1. Identify existing principles to design a base map.
2. Develop a base map for an air quality dataset.
3. Evaluate the effectiveness of the base map.

METHODOLOGY

BASE MAP CREATION

Based on the literature and reviewed general-purpose base maps, a custom base map was developed for a dataset of the Air Quality Index in Madrid. The base map's appearance, interactivity, and content were customized. For the latter, particular attention has been

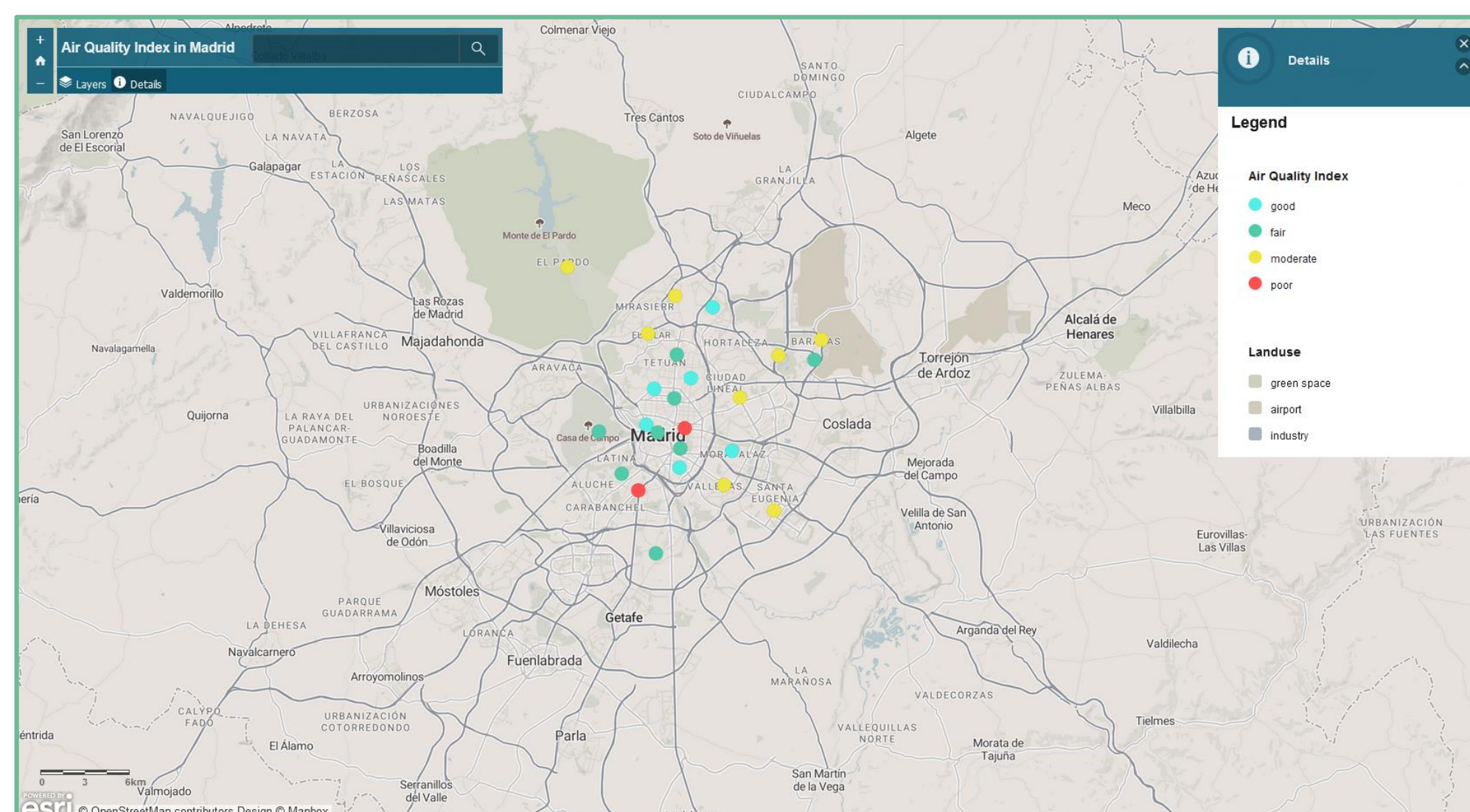


Fig. 2: Web application with the custom base map

given to factors influencing the thematic data to consider the semantics. The design choices were visualized using the ScaleMaster diagram [3]. A thematic web map was then created using the customized base map.

USER TEST

An online survey was conducted with 104 participants to test the effectiveness of the custom base map, comparing it to a general-purpose base map used as a benchmark map (see Fig. 1). In the survey, participants had to solve map comprehension tasks and could provide feedback on the custom base map design.

RESULTS

The user test revealed that the custom map outperformed the benchmark map

in all aspects: More participants answered the questions correctly, they responded faster, and they found the tasks easier to solve. The results indicate that the custom map was more effective. While the value of customized maps has been recognized in the literature, this study supports it with empirical evidence. The following challenges in base map design were identified:

- Finding a balance between distinguishable map features and low visual hierarchy.
- Finding a balance between map details and simplicity.

Following the user feedback, the base map was refined by making minor adjustments for an improved understanding of the map's theme (see Fig. 2).

CONCLUSION

In this study, a methodology was developed to create a custom base map. The user test underscored the importance of base map customization to enhance the understanding of thematic maps. However, further user tests are required to draw general conclusions. For more qualitative insights, user testing could be extended with eye-tracking and interviews. The utilization of AI could also be explored.

THESIS CONDUCTED AT

Research Division Cartography
Department of Geodesy and Geoinformation
Technische Universität Wien



THESIS ASSESSMENT BOARD

Chair Professor & Supervisor:
Univ.Prof. Mag.rer.nat. Dr.rer.nat.Georg
Gartner, Technische Universität Wien

External Supervisor:
Dr David Fairbairn, Newcastle University

Reviewer:
Dr.-Ing. Holger Kumke, Technische
Universität München

YEAR

2024

KEYWORDS

Base Map, Map Design, Air Quality, Thematic
Map Interpretation

REFERENCES

- [1] Muehlenhaus, I. (2014). Web cartography : Map design for interactive and mobile devices. CRC Press.
- [2] Arnberger, E. (1977). Thematische Kartographie. Westermann.
- [3] Brewer, C. A., & Buttenfield, B. P. (2007). Framing Guidelines for Multi-Scale Map Design Using Databases at Multiple Resolutions. Cartography and Geographic Information Science, 34 (1), 3–15.

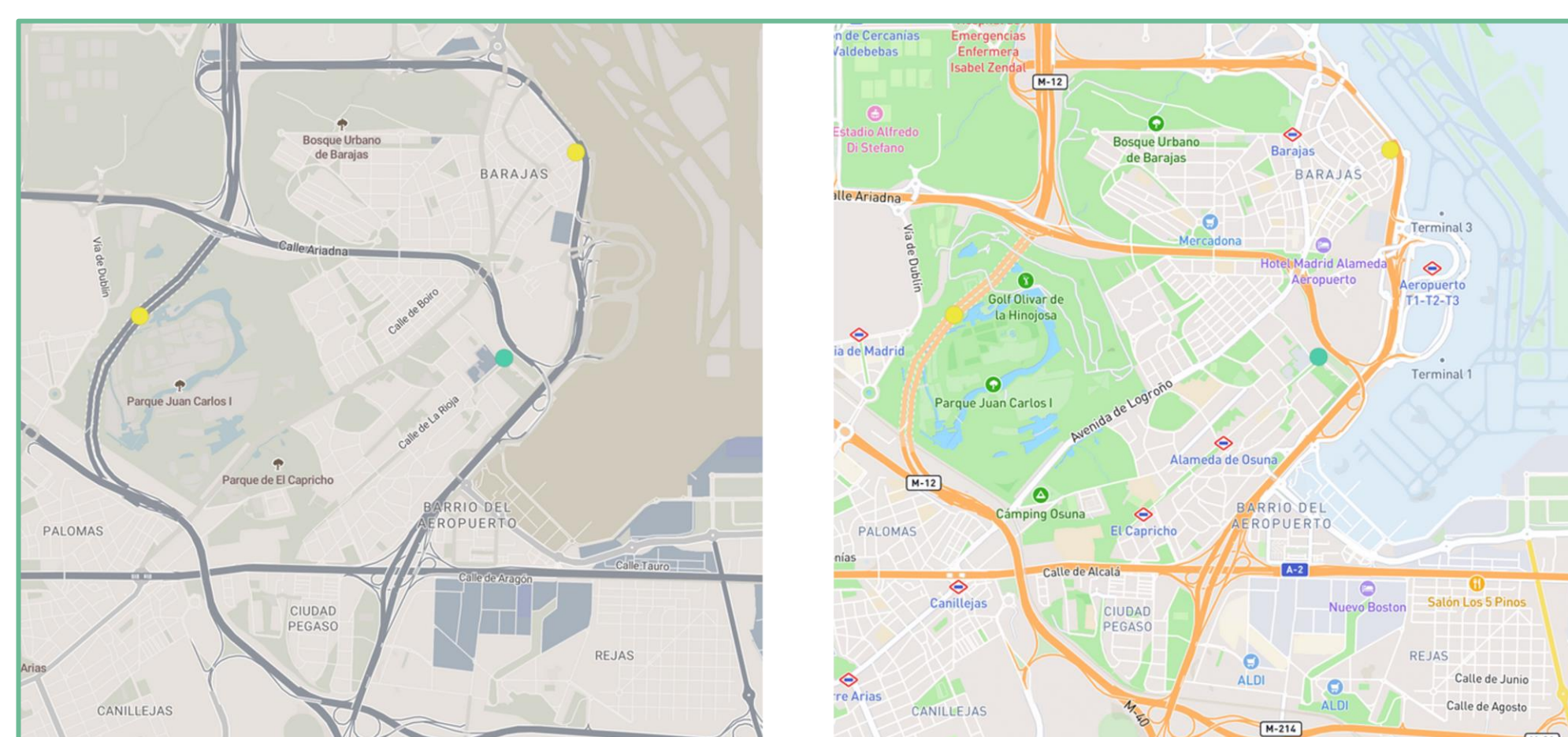


Fig. 1: Detailed view of the custom map (left) and benchmark map (right)

This master thesis was created within the Cartography M.Sc. programme – proudly co-funded by the Erasmus+ Programme of the European Union.

