International Cartographic Association
Association Cartographique Internationale

The complexity of simplicity: on the perception of schematized thematic maps

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Keywords: schematization, visual computing, computational geometry, thematic mapping

Abstract:
We explore the impact of schematization on thematic maps, in particular how map readers perceive them: how does schematization influence typical map interactions such as orientation, counting, comparing or estimating (Morrison, 1978, Roth, 2012). Computer scientists (Meulemans, 2014, p. 124) join cartographers (Monmonier, 1991, p. 38) in claiming that schematization affects perception: it reduces visual clutter and counters the "false aura of accuracy", which refers to the illusional accuracy thematic data acquires when it is presented using detailed geo data. However, we lack empirical evidence on these effects.

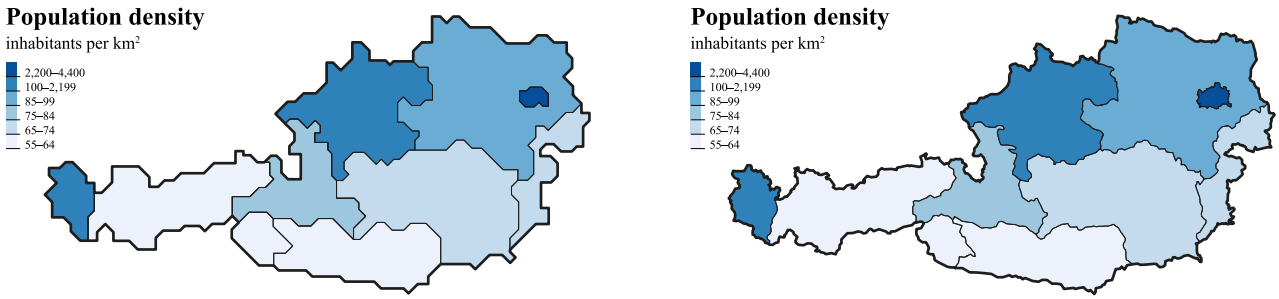

Figure 1: Comparison of a schematized and a traditionally generalized choropleth map.

We identify two research questions on schematized thematic maps:

- (A) In their studies on schematized network maps, Roberts et al. (2023; 2017, 2013) claim that there is a discrepancy between subjective preference and objective performance for schematized network maps: participants' preference does not correlate with their performance. I.e., study participants would prefer maps, considering them to perform well, even though in fact the objectives measures (like the time it takes them to answer a question with that map) indicates the contrary. To which extent does this discrepancy also apply to thematic maps with schematized polygons?
- (B) The "false aura of accuracy" suggested by Monmonier (1991) has not yet been empirically studied in the context of schematized maps. This study aims to show this effect on thematic maps with and without schematized polygons. How does schematization affect the perception of the thematic's data accuracy?

The first research question is based on the following idea: lower cognitive load allows map readers to more effectively and efficiently interact with the map. The geometry in schematized maps adheres to strict constraints, making them visually less complex than non-schematized maps – see e.g. the rules of legibility by Bertin (2011). It can thus reduce visual clutter and ultimately the map reader's cognitive load (Bunch and Lloyd, 2006). However, this may come at a cost: depending on the familiarity with the mapped region, it might be more difficult to recognize schematized polygons than conventionally generalized polygons.

The second aspect is not related to readability or effectiveness but has an ethical component: Monmonier (1991) criticizes the common practice to use detailed geo data to present vague or simplified thematic data. The accuracy of the geo data suggests a higher accuracy of the thematic data. This effect is sometimes abused to create authority.

Abstracts of the International Cartographic Association, 10, 176, 2025
32nd International Cartographic Conference (ICC 2025), 17–22 August 2025, Vancouver, Canada.
https://doi.org/10.5194/ica-abs-10-176-2025

Roberts (2023) presents four ways to evaluate schematized map designs, among them user evaluation and performance measurement. We will conduct a quantitative user study using these two ways of evaluation. The number of participants will be determined with a power analysis. The study will follow a within-subject design. The map samples as well as the tasks will be presented to the participants in random order.

The study design requires a set of map samples. The majority of schematized maps can be found in the context of infographics and data journalism. They are usually static visuals (no interaction). Therefore, the samples will be static. The set will consist of map pairs: a map with regular polygons and with schematized polygons. Besides the polygon geometry, the maps of each pair are designed as similar as possible in terms of content, layout and style. The maps will depict fictitious spatial (and thematic) data, to avoid biases due to different familiarity with the depicted regions among the participants. The sample will be limited to three common thematic map types: choropleth maps, flow maps and proportional symbol maps.

The study will be conducted online; participants will see maps of both types in random order. For every map, they will be asked to perform map reading tasks: e.g., finding specific features on the map, determining maxima and minima in the thematic data and comparing geographical features. The tasks will be timed and the participants will be asked for feedback on the maps; they will self-assess the difficulty of solving the given tasks. These assessments can then be compared with the effectiveness of each map type (research question A). In a second part, participants will be asked to evaluate the trustworthiness of the maps and to evaluate whether the accuracy of spatial data and thematic data aligns (research question B). First results of the user study will be presented at the ICC 2025 in Vancouver, Canada.

Schematized maps can be useful in multiple contexts. However, they are still sparsely used. In this study, we analyze how schematized thematic maps are perceived: does subjective usability correlate with objective usability? Do we observe a “false aura of accuracy”? With the answers to these questions, we contribute to a better understanding of how to use schematized maps effectively.

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