Automated Polygon Schematization for Thematic Maps

by **Jakob Listabarth**

Schematization is a powerful mean of communication. Therefore, it is widely applied in cartographic practice. Despite their frequent use, schematized maps are usually still drawn by hand: a slow and tedious process. The lack of accessible tools facilitating automated schematization explains why schematization is usually still a manual process. And yet numerous algorithmic approaches to generate schematized maps have been published over the last two decades. Nevertheless, none of these algorithms have been implemented into an accessible working cartographic service.

Scope

Based on implementing a proof-of-concept prototype for a web-based schematization tool, the thesis aims to evaluate the practical feasibility of such a tool. To this end, cartographic requirements for using schematized regions in thematic maps were examined. This examination was led by design principles which scholars mention regarding thematic maps [1,3]. Then, a suitable schematization approach was chosen, based on a comparison of existing algorithms. Furthermore, crucial software requirements regarding a web-based schematization tool were specified. Finally, the prototype was evaluated. The prototype, the requirements and its evaluation expose constraints and challenges of such a cartographic schematization service.

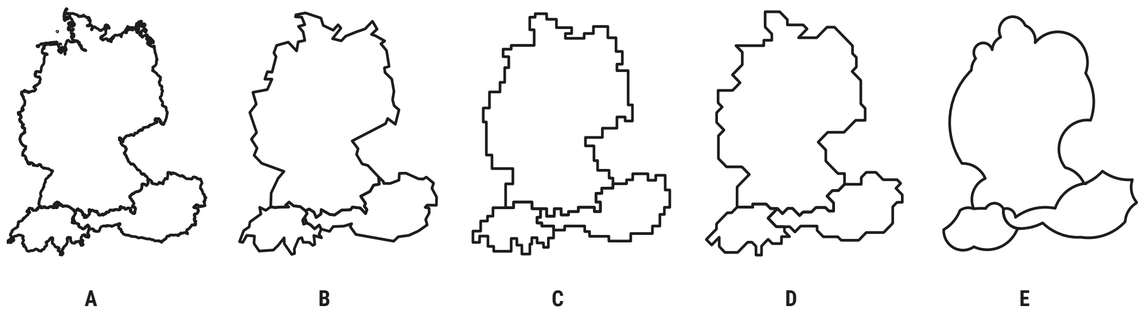

Fig. 1. Subfigure A shows the original region which is simplified in sub-figure B. Subfigure C (rectilinear) and D (octilinear) show a C-oriented schematization, whereas sub-figure E shows a curved schematization.

Methodology

A literature review was conducted to identify characteristics of polygon schematization [4]. Using these characteristics, schematization algorithms for polygons were systematically compared. Furthermore, prototyping was applied in combination with a simplified software-requirement-engineering process.

Prototyping implies an iterative development. An example for this is revising the visual design of user interface components in the mock-up prototype. The chosen algorithm was implemented within a technical and incremental proof-of-concept prototype. For this, requirements outlined technical and cartographic aspects, i.e., the design principles. They contain several levels of requirement information. The requirements are the basis for the concluding prototype evaluation in the requirement verification.

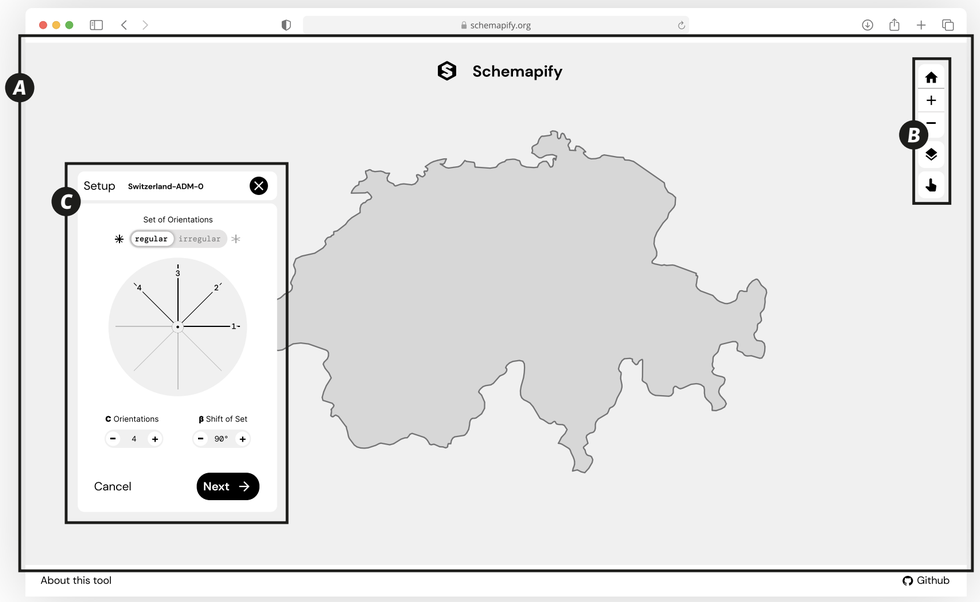

Fig. 2. The mock-up prototype is a clickable digital prototype focusing on the graphical user interface. The interface consists of the map-view (A), the map control panel (B), and the floating panel for schematization functionalities (C). This specific screen allows the user to adjust schematization parameters.

Results

The design principles for applying schematized regions in thematic maps show the following: visual characteristics of schematic outlines align with design principles for thematic mapping. However, schematization on its own cannot guarantee a legible, efficiently designed map. The comparison demonstrates that existing algorithms cover various schematization styles and exhibit heterogeneous geometric properties. The C-oriented schematization approach by Buchin et al. [2] was chosen for implementation. This is because it is flexible regarding style variations and its computation complexity is comparatively low.

The software requirements expose that validating input data for geometric particularities is a crucial preliminary for a stable system. They reflect the need to consider error sources originating from the input data's geometry. Further considerations are handling projections and designing an interface which provides meaningful feedback to the user and allows an efficient setup of schematization parameters.

The evaluation, conducted with the requirement verification, reveals shortcomings in system capabilities and the current user interface implementation. Therefore, upcoming development and prototyping steps will focus on these aspects.

Conclusion

This thesis outlines the implementation of a prototypical web-based schematization tool. It shows that such a tool is feasible. Nevertheless, computational time constraints decreased performance. Above all, the tool's robustness needs further attention. Only then can the approach be transferred into a useful tool, which blends in smoothly into common map-making workflows.

Thesis Conducted at

Department of Geo-Information Processing
Faculty of Geo-Information Science and Earth Observation
University of Twente (UTwente)

UNIVERSITY OF TWENTE.

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Year

2021

Keywords

schematization, generalization, thematic mapping, automated cartography, cartographic web services

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

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