Cartography M.Sc.

MapColPal – a color palette generation and testing tool for thematic maps

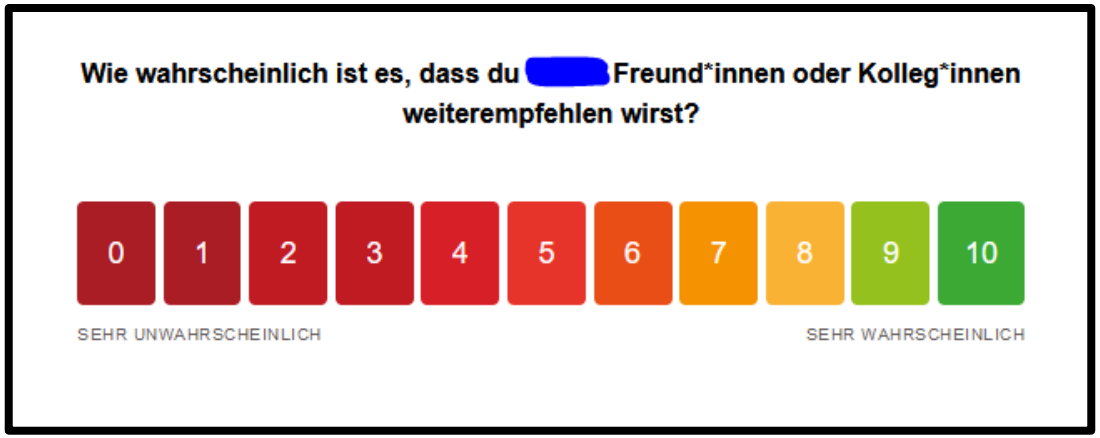
Valerian Lange

Outline

1. Introduction and Motivation
2. Research Objective
3. Methodology
4. Color use in cartography
5. Related work
6. Implementation
7. Results
8. Conclusion

Introduction and Motivation

- Color can be fun to work with
- Color is crucial – Generally, and in cartography!



- Latest major tool in cartography: ColorBrewer, about 20 years old

Research Objective

The research objective of the thesis was to

design, build, and evaluate a tool to assist cartographers in choosing suitable color palettes for thematic maps.

1. What criteria are necessary to decide whether to use a color palette for a thematic map?
2. How can a new tool improve upon existing color palette generation and testing tools?
3. What requirements exist for a tool implementing these criteria and improving upon the existing tools?
4. How can these requirements be implemented in a proof of concept?
5. Does the proof of concept fulfill the requirements set before?

Methodology

1. What criteria are necessary to decide whether to use a color palette for a thematic map?
2. What color palette generation and testing tools exist already? How can a new tool improve upon the existing ones?
3. What requirements exist for a tool implementing these criteria and improving upon the existing tools?

→ Requirements engineering

4. How can these requirements be implemented in a proof of concept?

→ Prototyping

5. Does the proof of concept fulfill the requirements set before?

→ Heuristic evaluation

Color use in cartography

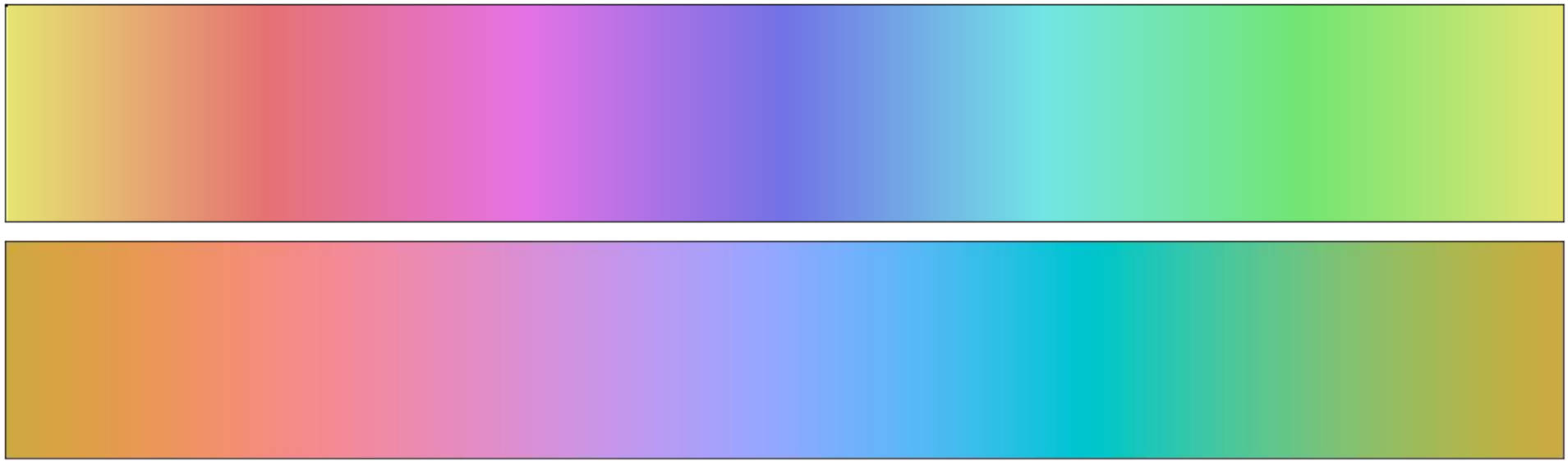
Colors need to represent data accurately

Purposefully use color and its attributes as a visual variable

How can this be done?

Color use in cartography

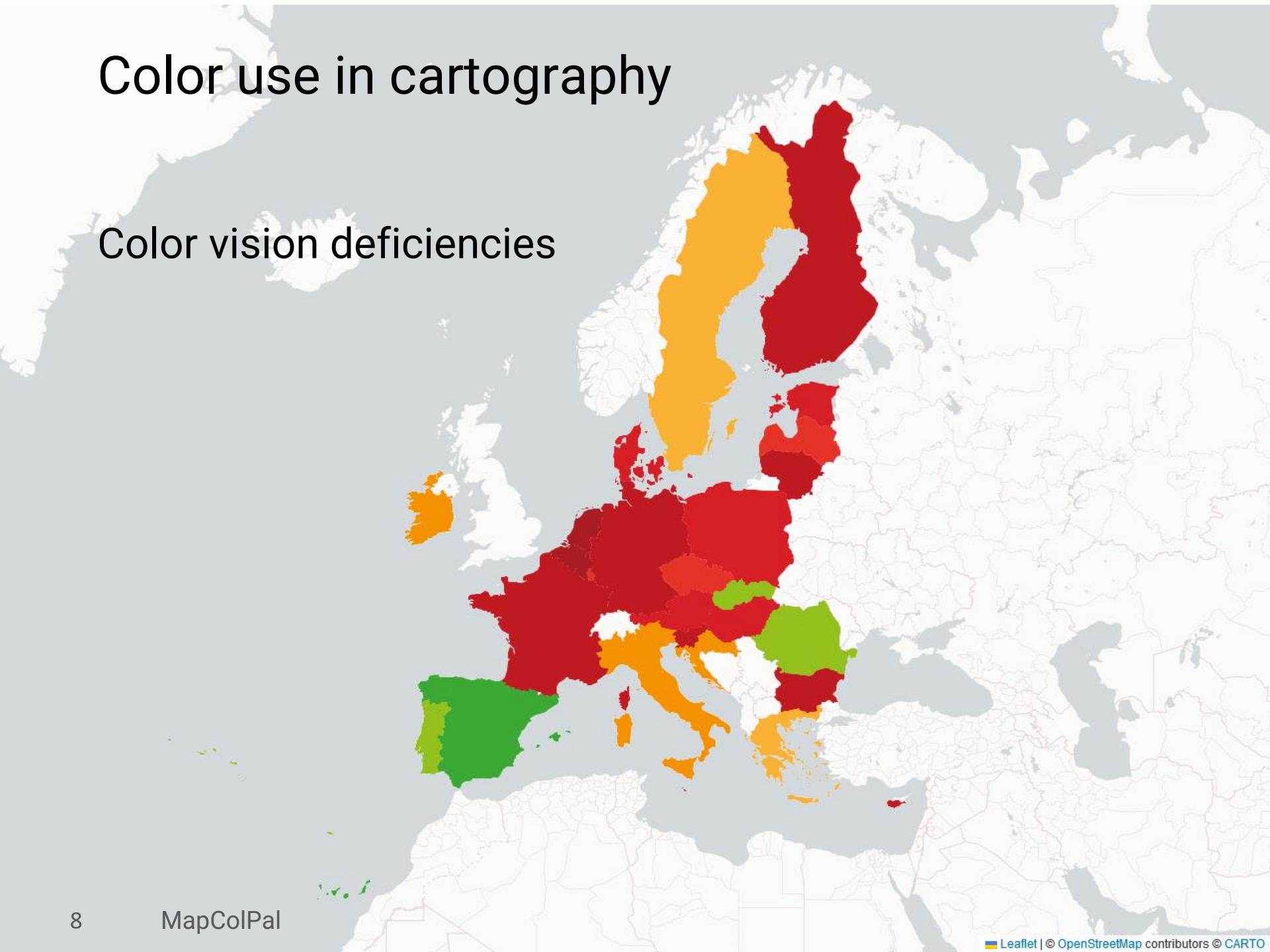
Perceptually uniform color spaces



Source: Ottosson, 2020

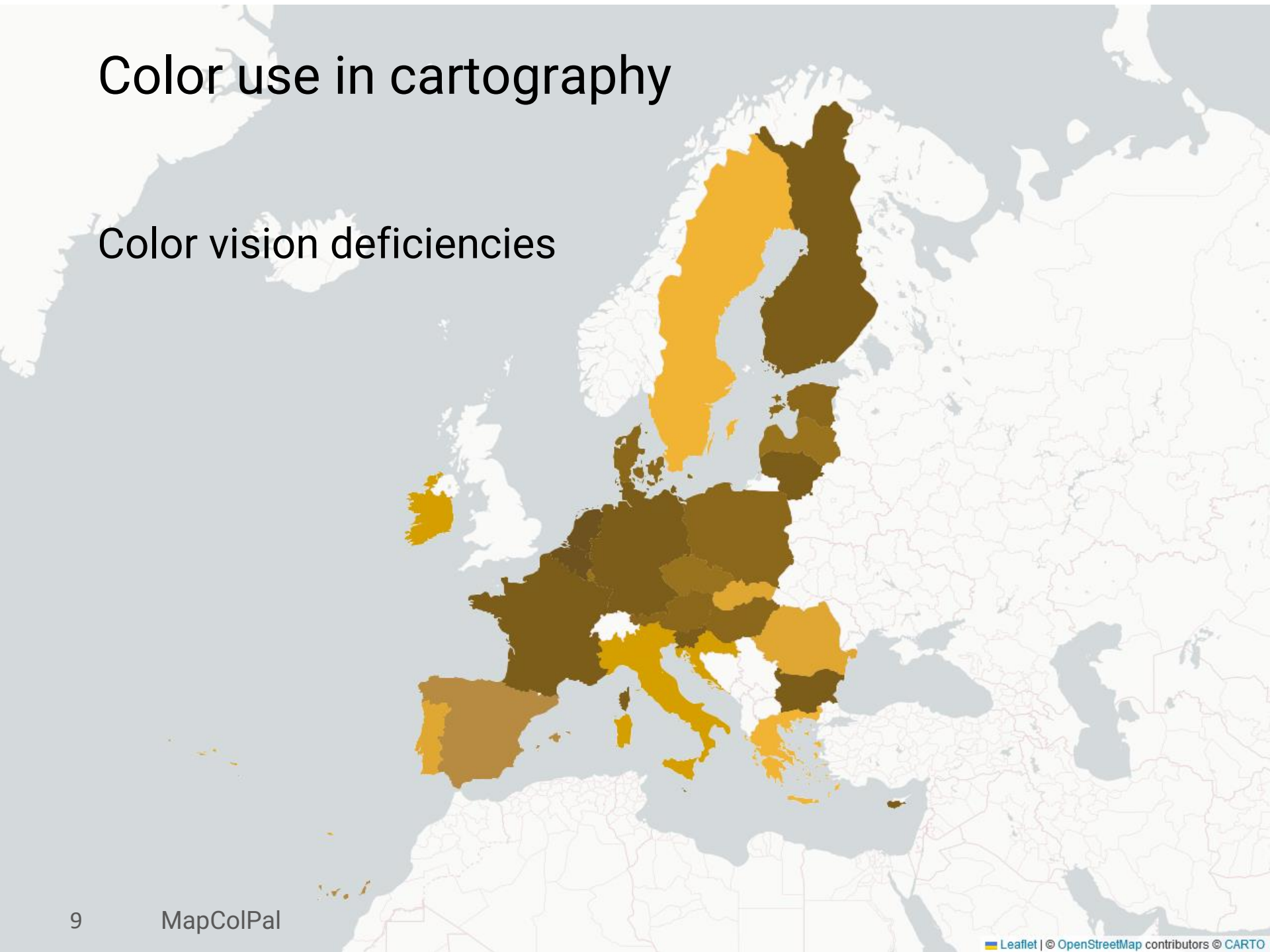
Color use in cartography

Color vision deficiencies



Color use in cartography

Color vision deficiencies



Criteria for a suitable color palette for thematic maps

- Suitable for type of data
- Considering human perception
  - Colors are notably different
  - Colors are correctly spread out in a perceptually uniform color space to represent the data
  - Considering simultaneous contrast (and similar phenomena)
  - Considering color vision deficiencies
- Is aesthetically pleasing
- Colors are harmonious
- Supporting the position of the map layer within the visual hierarchy of the map
- Suitable for the deployment situation of the map
- Tested before use to ensure meeting the other criteria

Related work

ColorBrewer as main benchmark, other tools supporting

- General layout will be adapted after ColorBrewer
- Three types of palette established (sequential, diverging, and qualitative)
- Other tools offer additional graphs or automated tests for palette evaluation

All tools lacking in multiple ways though

- If map visualization, then only choropleth map
- If basemap, only one terrain option

Criteria for a cartographic color palette tool

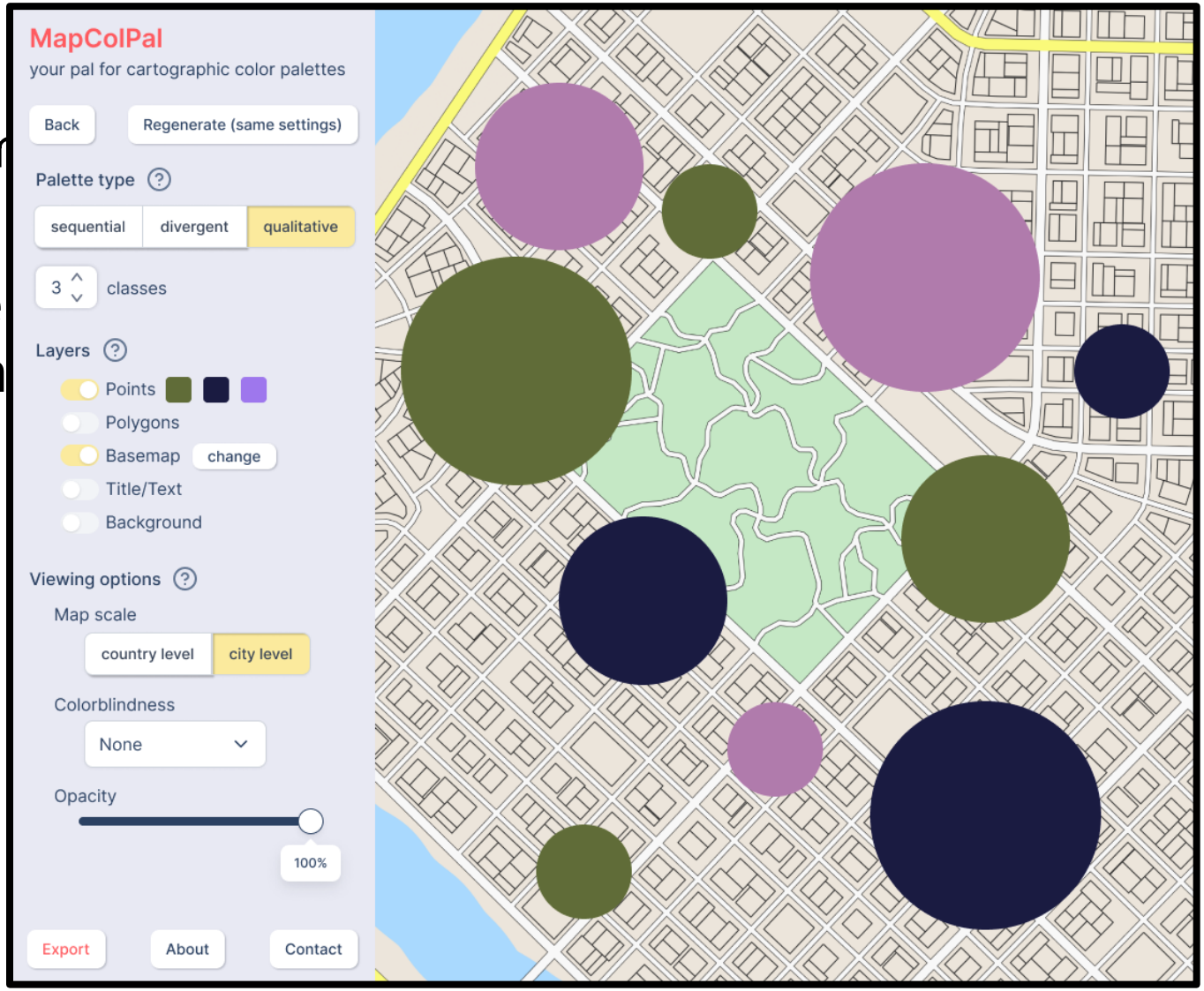
- Easy-to-understand screen layout and user interface like the ColorBrewer design
- Palette generation and testing for the types 'sequential', 'diverging', and 'qualitative'
- Example visualization for relevant types of map
- Example visualization in front of a selection of basemaps
- Additional graphs to help evaluate the color palette visually
- Automated tests and algorithms to ensure a certain quality level for the generated output

Implementation

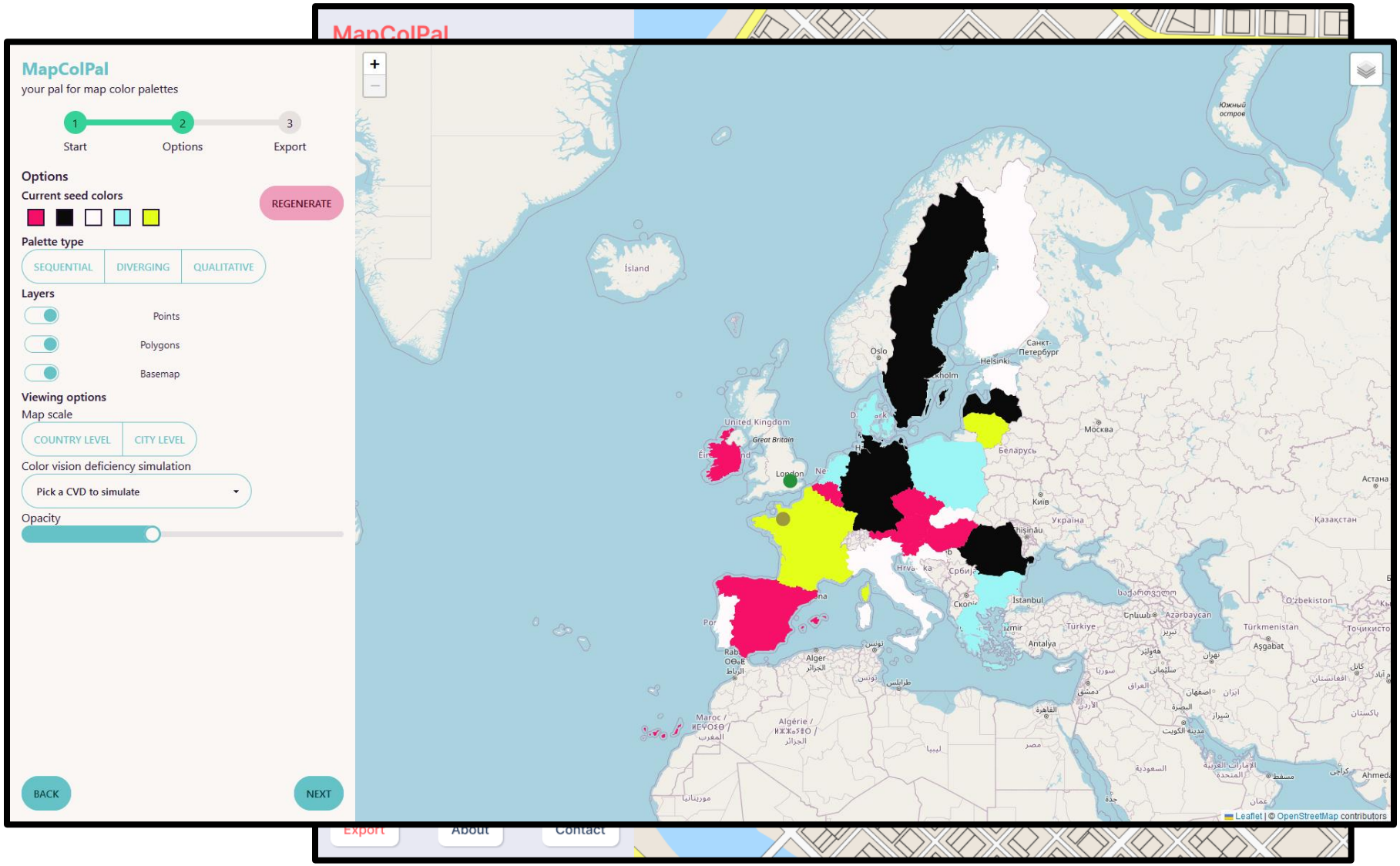
- Requirements based on both kinds of criteria
- Implemented iteratively, started with wireframe, then started programming

Implementation

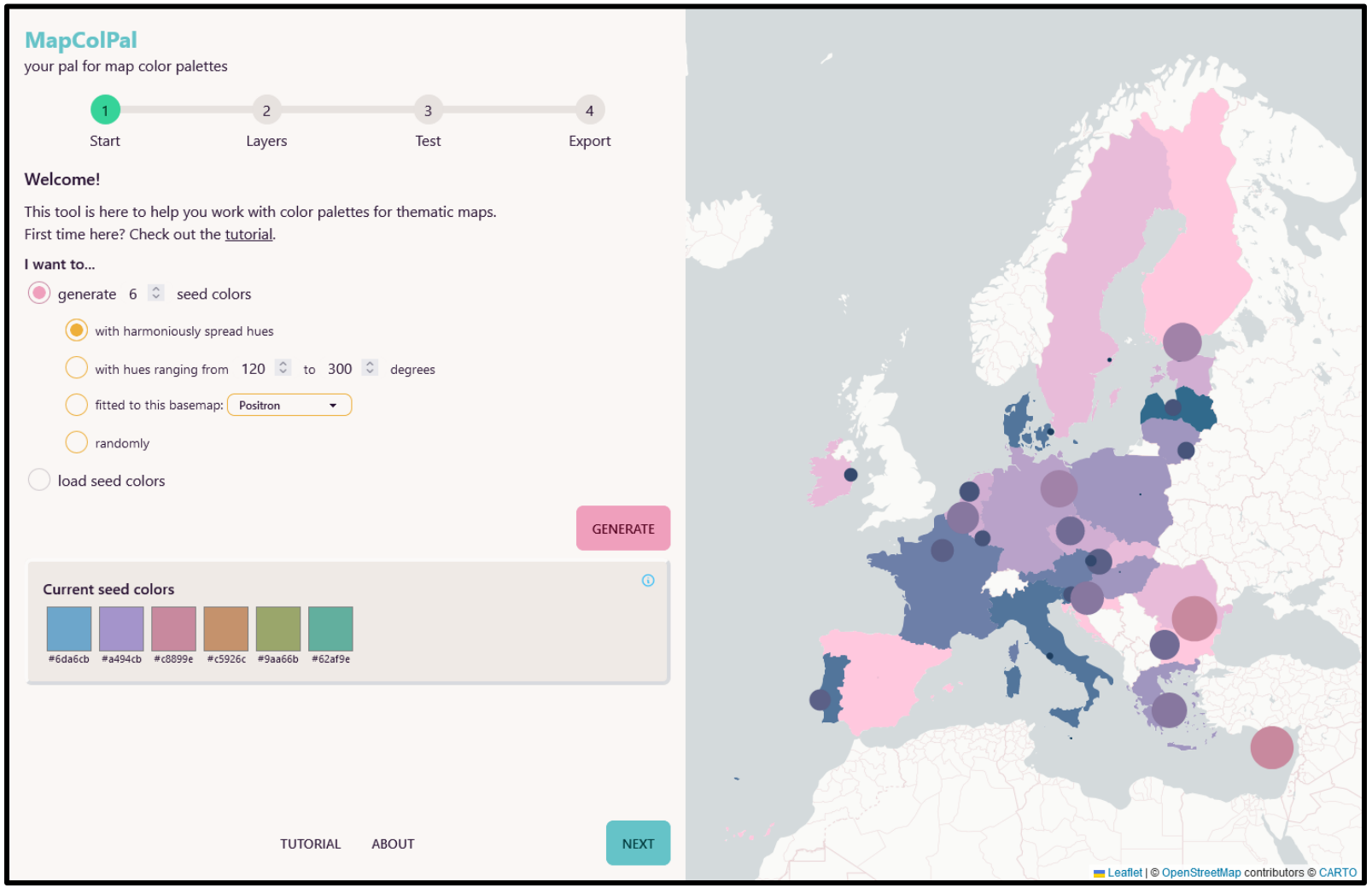
- Requirem
  criteria
- Impleme
  wirefram



Implementation

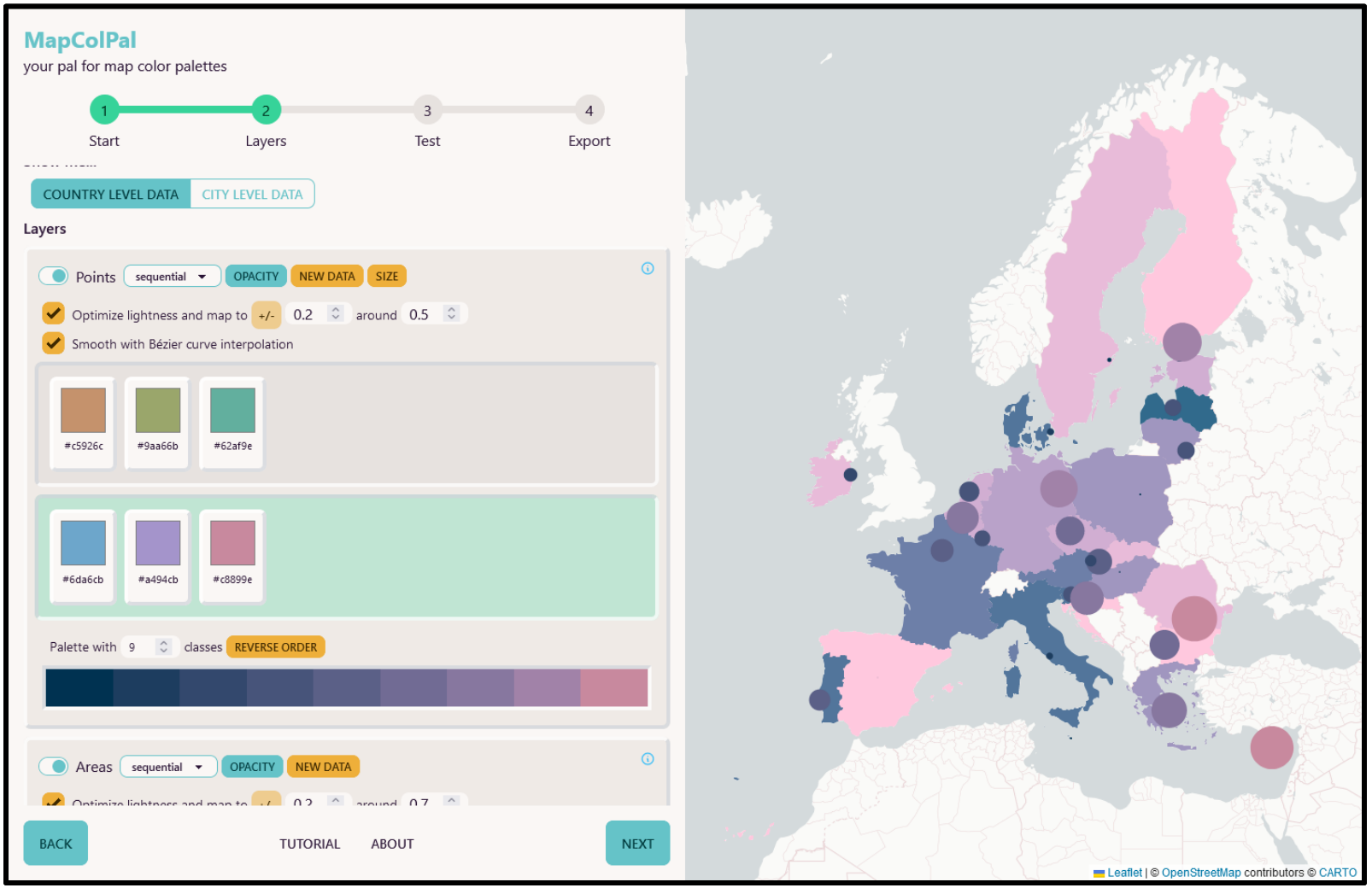


Results – Proof of concept



https://mapcolpal.org/

Results – Proof of concept



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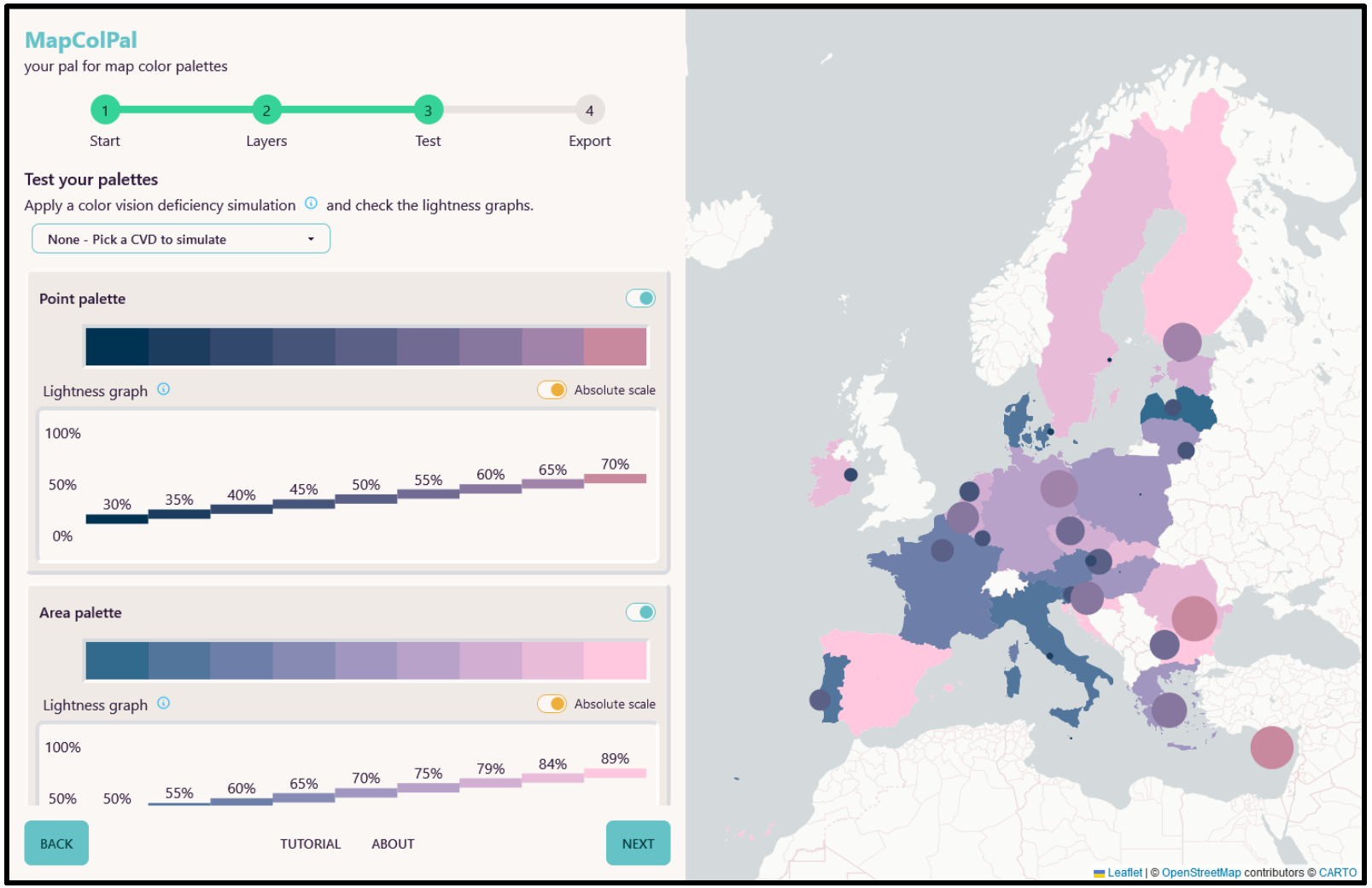
Results – Proof of concept



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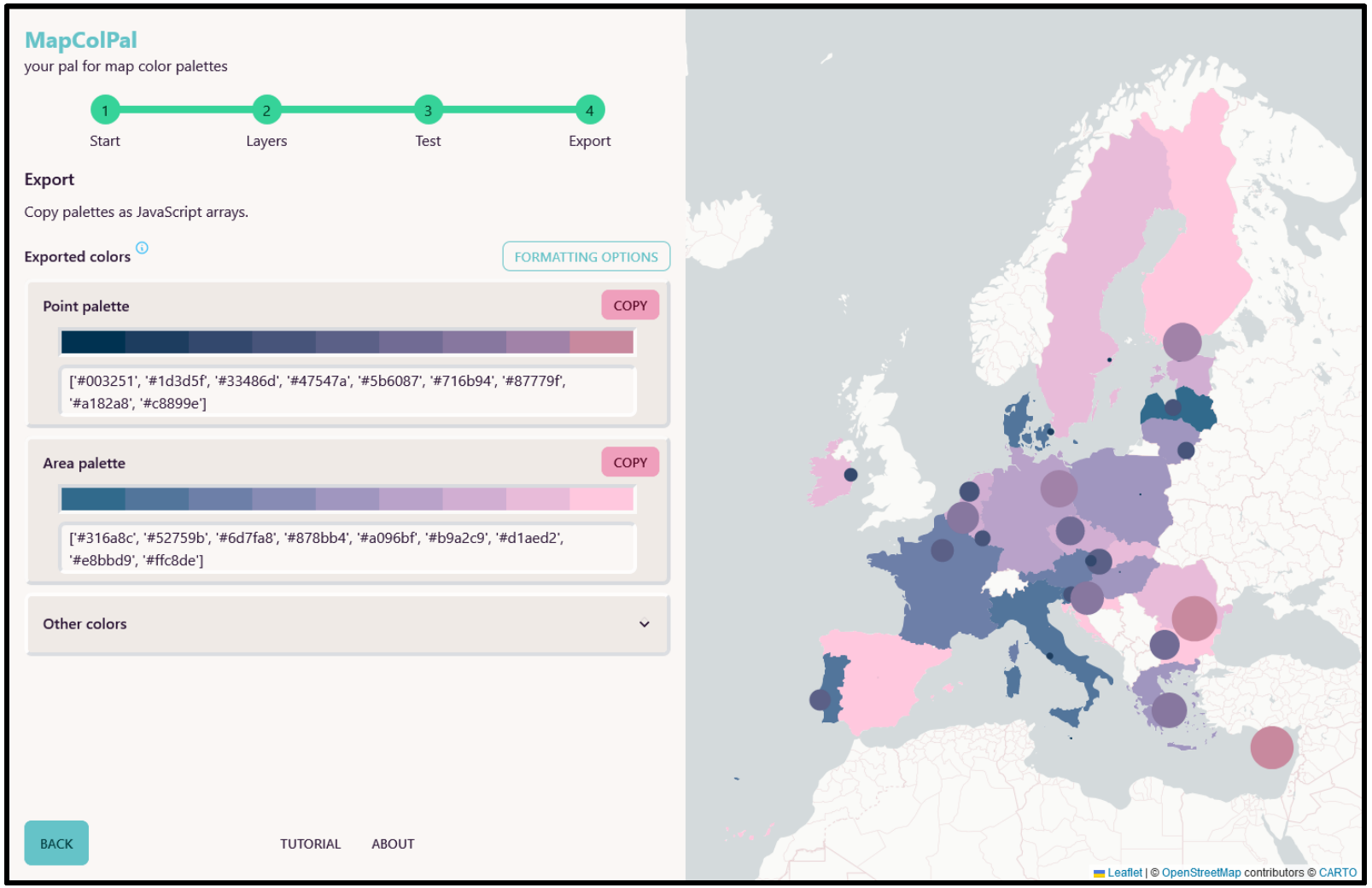
Results – Proof of concept



https://mapcolpal.org/

Results – Requirements check

✓ 11 of 19 requirements met

? 5 partly met

✕ 3 not met

➔ Missing: automated palette checks

Results – Heuristic evaluation

✓ 20 of 28 heuristics passed

? 5 unclear

✕ 3 not passing

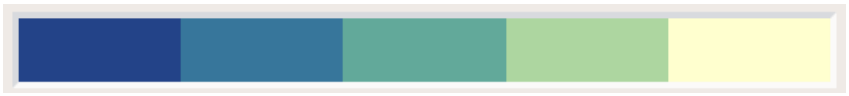
➔ Simplify wording in app,

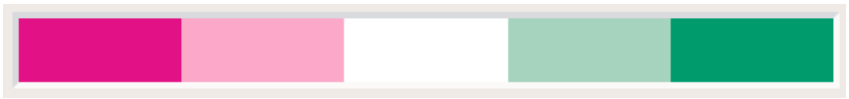
provide more information contextually

Results – Sample results

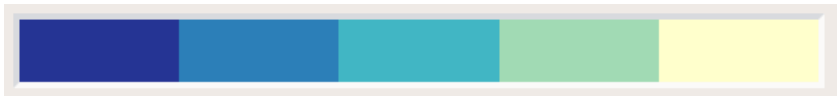
Sample results using only basic features and comparison to ColorBrewer

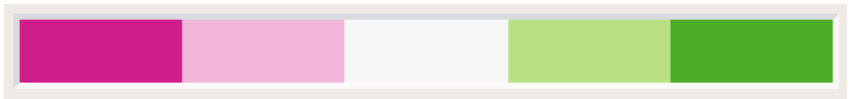
MapColPal





ColorBrewer





Conclusion

Coded a working proof of concept!

✓ can create ColorBrewer-like palettes for map use

✓ provides features to visually evaluate them

× currently requires in-depth knowledge,
can be reduced with further planned and suggested features

 Exciting possibilities for further research!

Thank you for your attention!

Any questions?

References

Ottosson, B. (2020). *A perceptual color space for image processing*. Retrieved 15.09.2022, from https://web.archive.org/web/20220915200056/https://bottosson.github.io/posts/oklab/