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Map design makes a difference

Geographic data are used by broad audiences for solving many difficult problems. Access to geographic data is mainly by maps, which are visual interfaces to information stored in spatial databases. Geoportals are used to find, access and display geographic data in viewing services, via the Internet. Novel opportunities and techniques for displaying geographic data in viewing services also introduce new challenges and issues. From this aspect, geoportals differ from common map products by the lack of a cartographer, who selects and optimizes data presentations and design according to the map purpose. Cartographic design can be studied with eye-tracking, which is a commonly utilized method to study visual search problems and provide design guidelines to improve usability. Cartographic designs can be compared by using an eye-tracking methodology, an eye-tracking experiment, to find designs that work better.

Previous studies introduce new methods that help to solve challenges and issues with cartographic design, but none of these have explicitly studied thematic polygon layer design. Specifically, if thematic layers hide information in the background map and to see the extent and location of the polygon layer, that overlap each other. These affect the readability and usability of the geographic data viewed in maps and geoportals. This is important because many EU countries are now setting up the geoportals. Swedish Standardization Agency coordinates an ongoing (2015) project in web cartography (SIS/TK 570) which among others, include design recommendations for thematic polygons. To verify the best design principles in geoportals empirical evidence are needed. Furthermore, perceiving information efficiently and effectively is risen into the research agenda because graphical environments are turning more complex and hard to understand.

In this study, 32 participants with knowledge in cartography/geography/GIS were asked to solve practical map reading tasks in a controlled experiment. To compare different cartographic design principles for polygon objects, four design techniques (boundary lines, transparency, hatches and icons) were empirically tested on 16 physical map areas.

Empirical results show that to interpret the extent of the polygon, the hatches design gave better results. As the hatches had the shortest scan path, fixation duration and fixation count, one could assume that this map design was easily was good and easily interpreted.

Based on the analysis, a design that includes elements from various designs would be a good improvement. For example, when including likeability of the transparency (to make readers like the map more), overall usage of borders and overall best performance for the hatches design, optimal design combination for geoportals can be recommended. Eye-tracking offers additional information, more than just reaction time and correctness of answers. From the eye-movement data it is possible to conclude why the reaction time and quality of inference are different between designs. The results can be generalized for similar thematic polygons and map reading tasks as used in this study.

Keywords: physical geography, geography, map design research, cartographic design, thematic polygons, eye-tracking, geoportal, cognitive cartography.