

Eye-tracking Assessment of Swipe and Multiple Views

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Abstract:

Although interactive map comparison is a fundamental task for geographers, an analysis of the effectiveness, efficiency, and user satisfaction of various interactive methods has not previously been attempted. The submission aims to compare two techniques of interaction which enable map comparison – swipe and multiple view. Swipe enables the user to swipe the upper map across the lower map. Multiple view (juxtapose) places two maps side by side. Both maps are linked, and any change in the first map's coordinates is immediately reflected in a change in the second map.

Both analysed map comparison methods are implemented in desktop GIS and online web map applications. According to our previous experiences, we experienced that users have problems with the use of swipe in the Esri environment and instead toggle layers on and off. To analyse the usability of map comparison tools, we decided to design an eye-tracking experiment where outputs of the Urban Planner model (land suitability maps) will be used as stimuli. The research question in this usability study was: **Which method of user interaction is more suitable for map comparison – swipe or multiple view?** A total of 25 participants participated in the experiment. These participants were recruited from two groups – students of geoinformatics (novices) and employees from urban planning departments (experts).

The experiment was designed in SMI Experiment Center using screen recording stimuli type. Land suitability maps were displayed via Web Map Applications in the Esri ArcGIS Online environment and were presented through an internet browser. After training tasks, participants commenced solving the tasks. The respondents were asked to determine the location (polygon) according to the question. Two sets of tasks were displayed. For the first four views, the task was to select the highest suitability in the marked area. Two tasks contained multiple view, while the other two contained swipe. In the first two tasks, participants had to compare two layers of suitability, and in the latter two, four of them. In the second group of tasks, the participants selected the area with a high value of suitability for housing and a low value for all the other types of suitability. The order of tasks was the same as in the previous group.

For the analysis in SMI BeGaze software, so-called custom trials had to be created, and dynamic Areas of Interest had to be marked in the recordings. This time-consuming process allowed us to analyse participants' eye movements in detail and evaluate the use of both analysed map comparison techniques. The results were visualised using sequence charts. Moreover, the differences in trial duration were statistically tested, and dissimilarities in the correctness of answers were evaluated.

Based on the results of the designed usability eye-tracking experiment, we conclude that:

- 1) Multiple view is a better method of map comparison than swipe, especially in a task which compares four maps.
- 2) The settings for swipe are not intuitive and require additional settings.
- 3) The only situation where swipe outperformed multiple view was a complex task where two maps were displayed.
- 4) The challenge in future research is to improve the swipe to compare more than two maps simultaneously.

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