

Animated Transitions in Statistical Maps

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This research develops possible transitions between maps and charts and determines how they affect user perception. There were two experiments conducted testing the effects on the syntactic and semantic levels of analysis.

The results revealed a positive influence of animation on identifying objects with the highest or the lowest value and no effects for tasks in which participants were required to determine trends. An object tracking test showed that tweening is a more effective technique than staging.

MOTIVATION AND OBJECTIVE

With the advent of animation, statistical data graphics became motional, simplifying data analysis and emptying screen space. However, it is not clear what kind of animated transitions are possible between maps and charts and how they might affect user perception. Therefore, the main objective of this research is to determine how animated transitions from statistical maps to charts and vice versa change user perception.

DESIGN OF TRANSITIONS

Three charts and three maps were selected for designing transitions between them. They are scatter plot (chart), bar chart, pie chart, proportional symbol map, flow map, and choropleth map. Each represents quantitative statistical data at discrete enumeration units.

Nine basic pairs of transitions between selected maps and charts were designed (Fig. 1). Each can apply additional transition techniques to enhance the animation ability to represent and communicate statistical data.

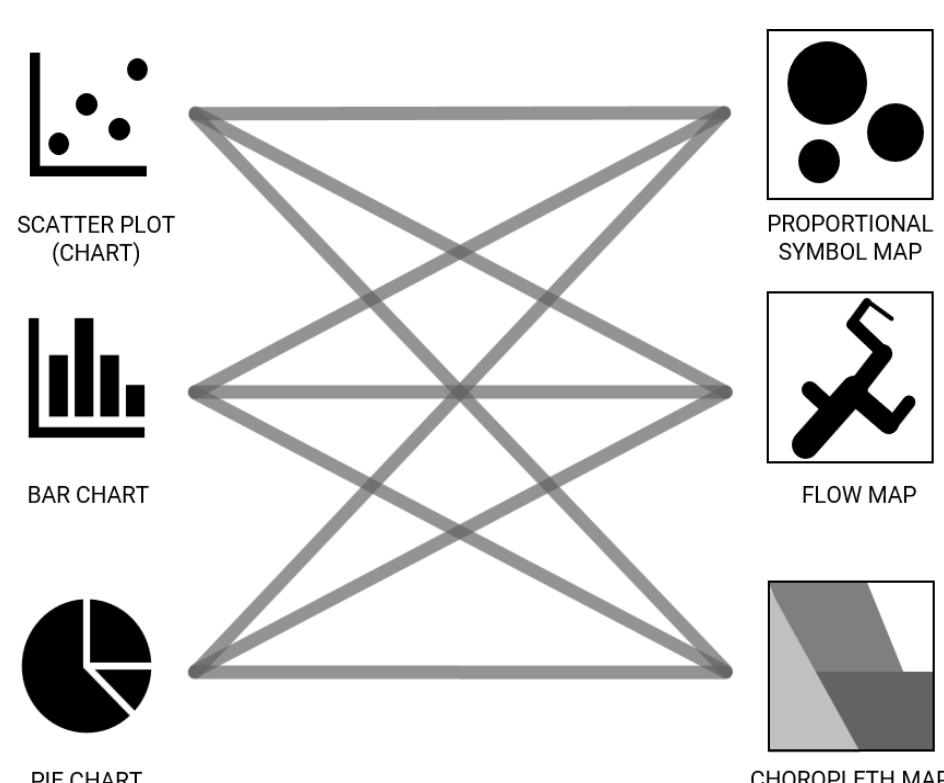
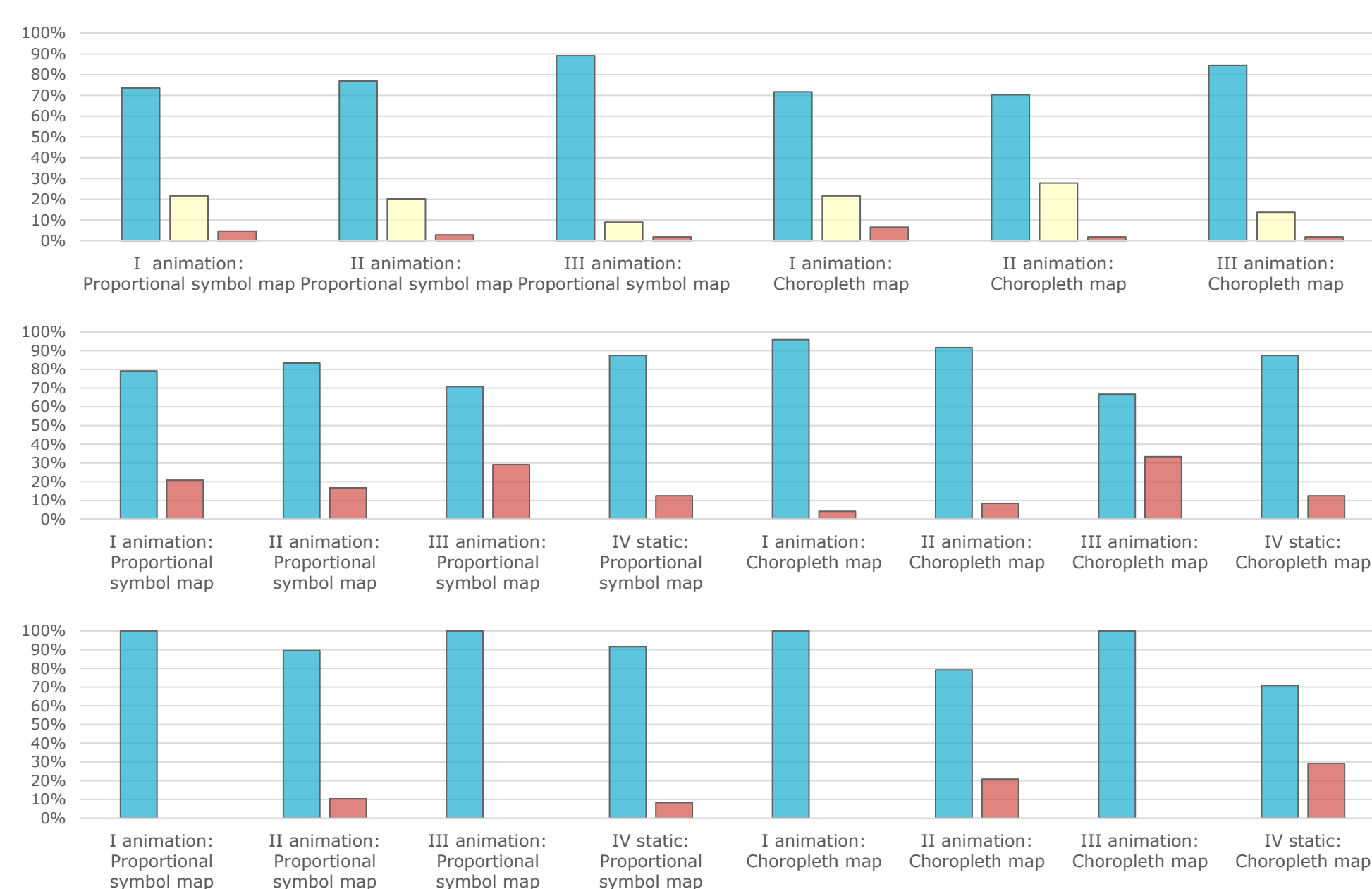


Fig. 1: Possible transitions between maps and charts.



From top: Fig. 2: Correct (blue), half-correct (yellow), and wrong (red) answers in object tracking; Fig. 3: Correct (blue) and wrong (red) answers in determining trends; Fig. 4: Correct and wrong answers in identifying the object values.

METHODOLOGY

Two experiments were conducted to test the effects of designed transitions. The first experiment set an object tracking test revealing transition effects on the syntactic level of analysis, in other words, it checks the ability to recognize and locate transforming objects in shape, size, and position. It compared three different animated transitions among each other. The second experiment is tested on the semantic level of analysis revealing transition effects on understanding of statistical data. This experiment narrowed down to identification of map trends and objects with the highest/lowest value. It includes tasks with animated and static graphics. The evaluation of results is based on answers' accuracy, time spent on completing each task, and subjective preferences.

RESULTS

The object tracking experiment results showed the advantages of tweening over staged animations in completing the tasks more accurately and faster (Fig. 2). They also demonstrated the better results achieved with proportional maps as compared to choropleths. Participants tended to be more successful in completing the tasks starting from charts than from maps. A fewer number of graphic components also positively affected the answer's accuracy.

Determination of trends did not reveal

any discernible influence of animation either in accuracy nor in timing; both static and animated tasks had equally good results (Fig. 3). In animated tasks, it showed the benefits of staging over tweening. Generally, choropleth maps had a higher number of correct results than proportional symbol maps when animated. Results highlighted a better performance of smooth staged animation for transitions with proportional symbol maps; and better results of sharp staged animation in combination with choropleth maps.

Identification of objects with the highest/lowest value displayed a greater number of correct answers in animated tasks than static ones (Fig. 4). Among transitions, smooth staged animation performed worse in accuracy than sharp staged and tweened ones. However, a comparison of the mean time spent on solving revealed a better performance of tweening. Additionally, there was no significant difference revealed in accuracy between proportional symbol and choropleth maps when animated. In static examples, proportional symbol maps had a greater number of correct answers than choropleth.

CONCLUSION

All in all, the experiments showed that transitions can have different effects on users' perception. On the one hand, it proves their effectiveness in some tasks, on the other hand, it speaks for the need of the further development for other types of tasks.

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animated transitions, statistical data, graphics, maps, charts, cartography

ADDITIONAL MATERIALS



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