Abstract

Saliency models are computational algorithms that predict the degree of attention each visual element has for a human observer. Several studies have used these models to create patterns, standards, and object recognition algorithms. Nevertheless, according to our research, saliency has been an instrument that has always been implicitly exploited in design standards or commonly used patterns, mostly invisibly from the end-users (and graph creators) awareness.

An example of hidden saliency uses can be seen in Data Visualization (DataViz). DataViz applications are already coming with well-established patterns, such as color palettes, that have been extensively studied using saliency models. This means that DataViz designers implicitly use the benefits of the saliency model predictions when selecting a preset pattern. Nevertheless, they are unaware that those patterns have a specific visual attention impact on the final observer.

The main objective of this thesis is to bring the information provided by the saliency models closer to the graph designer in a DataViz design process. The idea is to make explicit the potential impact of each design decision in the graph design process and allow the graph designers to exploit this information in their work. To that end, the first part of the thesis is a more profound study of saliency prediction models theory, their currently practical uses in InfoVis, and the functionality and performance of the InfoVis saliency models. Due to the novelty of the InfoVis saliency prediction models, we performed experiments on how these saliency models behaved on specific statistical graphs to validate their performance.

Based on the performance experiments, we choose a saliency model to integrate it into the graph design process. To achieve this integration, we propose two approaches described in the second part of the thesis. In the first one (\textit{Design Tool}), we explored a mechanism for assisting graph designers in attracting the observer's attention to specific relevant data they can choose, specify at design time. In the second (\textit{Measurement Tool}), we integrate the saliency model into a common DataViz application as a validation tool at the end of the design process. Therefore, the designer can visualize the visual attention implications of each design decision and iterate the visual elements in order to improve the result.

Six experts from academia and industry evaluated the developed approaches. In general, most results demonstrated that integrating saliency prediction models into the DataViz design process is a relevant and valuable technique. Notably, the experts mostly expressed that they had not seen this type of support in other tools, which means they have significant potential.

The presented thesis opens the possibility of linking two relevant areas of visualization, such as the study of salience and data visualization, not only to create new visualization techniques but also to bring the knowledge of both areas closer to the fewer experts. Finally, integrating these two areas, whose objectives intersect in decision-making support, could become a vital instrument to improve the final observer decision-making process.