CSCM27 – Visual Analytics Assessment 2

Objective of Paper

In this paper, Saket et al [3] seek to investigate as to whether the design of a visualisation can aid data comprehension and memorability. To do this, the authors conduct an experiment to test recall accuracy using node-link (NL) and map-based node-link-group (NLG) diagrams. The authors intend to evidence how these differing designs might affect data recall accuracy.

Difference to Existing Literature

The authors contend that it is well known that visualisations are more effective than other methods of conveying information and that different visual designs affect reading precision. What they claim is less well understood is how visual design impacts upon the memorability of the underlying data. With the above in mind, the novelty of the authors' study rests in the fact that no study has assessed how visualisations impact upon data memorability over a longer-term.

In perhaps the most closely related experiment detailed by the authors, Bateman et al [1] have tested the comprehension and recall of charts, but their experiment provided carefully selected prompts to subjects until such times as they either recalled all relevant information or ran out of prompts. This study has subsequently been replicated by Li et al [2], using charts consisting of more than 10 features. When compared with these studies, Saket et al do not use prompts, instead testing for unprompted data recall.

Support for Claims

The experiment conducted contained 40 participants and was undertaken in three phases. Furthermore, each visualisation type (NL and NLG) was created twice using two different data sets. Once to create a small graphic (50 nodes, 1.5 density), and once to create a large graphic (200 nodes, 2.5 density). Subjects were then split in to two groups, with each group looking at one of the visualisation types (NL or NLG). In phase one, subjects were permitted to look at the visualisations for as long as they might desire with no task to complete. In phase two, participants were asked to undertake 6 tasks but still retained access to the visualisations. In the final phase, the two participant groups were split in to two additional subgroups and were asked to complete the same 6 tasks and an additional 3 tasks without access to the visualisation. Each of the subgroups was given different recall conditions, either immediate (2 minutes) or long (4 days). The authors hypothesised (1a) that accuracy would be better for NLG subjects, but (1b) response times would not change, (2) that the effect size going from NL to NLG diagrams would be smaller in the immediate recall scenario, and (3) that the recall accuracy for small graphs would be higher. As null hypotheses, these are expressed as H1a, H1b, H2 and H3, respectively.

The authors' data analysis results are sufficient to reject H1a, and insufficient to reject H1b, H2, and H3. The primary results reported by the authors are that NLG graphs result in significantly more accurate recall. In addition to this, participants were better at recall in the immediate condition. It is also noted that large NLG diagrams are as good as small NLG diagrams in the long-term condition. The authors furthermore provide a breakdown of the accuracy of individual tasks executed, finding that tasks 7 and 9 show a decrease in performance for large NL diagrams. The authors note a potential difference in effect sizes between tasks 1-6 and 7-9. Therefore, to ensure that large performance differences have not affected the overall significance of the results, the authors run additional hypothesis tests, finding an effect size of 10% for the first six tasks, however, this is statistically significant ($p < 0.05$).

Regarding future work, as subjects explored NLG diagrams for 25% longer than NL ones, and owing to positive comments from the participants regarding NLG graphs, the authors suggest that further work on visualisation engagement might be useful. Furthermore, it might also be worthwhile exploring the long-term memory impact of other complex visualisations, so as we might begin to determine additional types of visualisations to aid long-term comprehension.

References

[1] BATEMAN, S., MANDRYK, R. L., GUTWIN, C., GENEST, A., McDINE, D., and BROOKS, C. Useful junk? the effects of visual embellishment on comprehension and memorability of charts. In *Proceedings of the SIGCHI conference on human factors in computing systems* (2010), pp. 2573–2582.

[2] LI, H., and MOACDIEH, N. Is "chart junk" useful? an extended examination of visual embellishment. In *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (2014), vol. 58, SAGE Publications Sage CA: Los Angeles, CA, pp. 1516–1520.

[3] SAKET, B., SCHEIDEGGER, C., KOBOUROV, S. G., and BORNER, K. Map-based visualizations increase recall accuracy of data. In *Computer Graphics Forum* (2015), vol. 34, Wiley Online Library, pp. 441–450.