Beyond Usability and Performance: A Review of User Experience-focused Evaluations in Visualization

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“Successful” Design = Meeting Usability Goals
“Successful” Design = Meeting Usability Goals

- Effectiveness
- Efficiency
- Utility
- Safety
- Learnability
Moving beyond usability-driven objectives
Human-computer Interaction

Bateman et al. 2010
Malone 1982
Shneiderman 2004
Sweetser e et al. 2005
Norman 2004
Sharp et al. 2008
Human-computer Interaction

Bateman et al. 2010
Malone 1982
Shneiderman 2004
Sweetser et al. 2005
Norman 2004
Sharp et al. 2008

What?
Did you say Memorability?

Stephen Few
Storytelling in Information Visualisation: Does it Engage Users to Explore

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ABSTRACT
We present the results of three web-based field experiments, in which we evaluate the impact of using initial narrative visualisation stories and storytelling on user engagement...

Is “chart junk” useful? An extended examination of visual embellishment
Haiyang Li 1 and Nadine Maudied2
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2 University of Michigan

Although many well-cited theories or guidelines for visualisation design advocate ‘minimalism’, designers tend to include a wide variety of visual embellishments in their charts. Researchers have examined the effects of visual embellishment on comprehension and memorability of charts under specific conditions, such as charts with a small number of data points that were viewed with no time limit (de Rui et al., 2010). This paper extends previous studies and investigates the effects of visual embellishment with different time limits for viewing the charts. Similar to the Bateman et al. (2010) study, we compare embellished charts (selected from the work of Nigel Holmes) and plain, unembellished charts, but we limit our selection to those that consisted of larger data sets (10 or more data points). Results show that it is a present time limit affected comprehension and short-term recall performance, while the type of visualization significantly affected short-term recall. In addition, the type of chart affected the time needed to encode the presented data.

Beyond Memorability: Visualization Recognition and Recall
Michelle A. Borkin, Member, IEEE, Zoya Bylinskii, Nam Wook Kim, Constance May Bainbridge Chelsea S. Ye, Daniel Borkin, Hanspeter Pfister, Senior Member, IEEE, and Aude Oliva

ENCODING
100 “large” visualizations
986 visualizations
393 visualizations
Visualizations are taken from [1] and the data is from the Table 1 is applied.

RECOGNITION
Some 100 images are 100 “small”
2 years / image
In-10 seconds / image
Out-of-10 seconds / image
Eye-tracking fixation locations with durations.
Out-of-2 seconds / image
Eye-tracking fixation locations with durations and selected visualizations are recognized.

RECALL
100 images, and the last 20 images are as many images as the algorithm can return.
Text descriptions of what participants recall about the visualizations.

Figure 1: Illustrative diagram of the experiment design. From left to right: the elements of the visualizations are labeled and cued, eye-tracking fixations are gathered for 10 seconds of “encoding”, eye-tracking fixations are gathered while visualization recognition is measured, and finally participants provide text descriptions of the visualizations based on blurred representations to gauge recall.

An Empirical Study on Using Visual Embellishments in Visualisation
Rita Borgo, Afife Abdul-Rahman, Farhan Mohamed, Philip W. Grant, Irene Reppa, Luciano Floridi, and Mirjam Teunissen

Abstract—In written and spoken communications, figures of speech (e.g., metaphors and synecdoches) are often used as an aid to convey abstract or less tangible concepts. However, the benefits of using metonymical metaphors or embellishments in visualisation is less understood. In this work, we report an empirical study to evaluate hypotheses that visual embellishments may aid memory and concept comprehension. One major departure from related experiments in the literature is that we make use of task methodology in our experiment. This design offers an abstraction of typical situations where viewers do not have full control over visualisation (e.g., in meetings and lectures). The secondary task introduces “divided attention”, and makes the effect of visual embellishments more observable. In addition, it also serves as additional masking in memory-based trials. The results of this show that visual embellishments can help participants better remember the information depicted in visualisation. On the other hand, embellishments can have a negative impact on the speed of visual search. The results show a complex pattern as to the benefits of embellishments in helping participants grasp key concepts from visualisation.

Useful Junk? The Effects of Visual Embellishment on Comprehension and Memorability of Charts
Scott Bateman, Regan L. Mandryk, Carl Gutwin, Aaron Genest, David McInnes, Christopher Brooks
Department of Computer Science, University of Waterloo, Baskov, Cornwall, Saskatchewan, Canada

Abstract—Guided by the principle of the “data-ink” rule (or the ink in the chart used to represent data), we examine the effects of visual embellishment on the comprehension and memorability of charts. We conducted an experiment in which participants viewed visualisation charts from the work of Nigel Holmes. The participants were asked to engage in the task of understanding and remembering the information depicted in each chart. The results of this study show that visual embellishments can have a positive impact on the comprehension and memorability of charts.

Map-based Visualizations Increase Recall Accuracy of Data
Babak Sadeh, Carlos Schlegel, Stephen G. Kobourov, and Katy Borner

Abstract—We investigate the memorability of visual data represented with node-link (left-side) and map-based (right-side) visualizations. The node-link visualization is a graph-based visualization with 200 nodes and 300 links from the LastFM dataset. The map-based visualization is a graph-based visualization with 200 nodes and 300 links from the LastFM dataset.

Fig. 1. Illustrative diagram of the experiment design. From left to right: the elements of the visualizations are labeled and cued, eye-tracking fixations are gathered for 10 seconds of “encoding”, eye-tracking fixations are gathered while visualization recognition is measured, and finally participants provide text descriptions of the visualizations based on blurred representations to gauge recall.

Fig. 1. Left: The top twelve overall most memorable visualizations from our experiment (most to least memorable from top left to bottom right). Middle: The top twelve most memorable visualizations from our experiment when visualizations containing human recognizable contents or images are removed (most to least memorable from top left to bottom right). Right: The twelve least memorable visualizations from our experiment (most to least memorable from top left to bottom right).
Qualitative Methods   Quantitative Methods   Qualitative + Quantitative
ABSTRACT
Traditionally, studies of data visualization techniques and systems have evaluated visualizations with respect to *usability goals* such as engaging experiences [41]. Multiple HCI researchers have emphasized the importance of emotion, enjoyment and fun, memorability, and engagement in their work [5, 19, 37, 55, 56]. As Rogers et al.
# Memorability, Engagement, and Enjoyment

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<tbody>
<tr>
<td>Bateman et al. [5]</td>
<td>Immediate memory</td>
<td><strong>Immediate Memory</strong>: Asked participants to recall as many visualizations as possible.</td>
<td><strong>Immediate Memory</strong>: Five minutes after performing tasks using those visualizations.</td>
<td>20</td>
<td>Bar chart, line chart, and pie chart</td>
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<td></td>
<td>Long-term memory</td>
<td><strong>Long-term Memory</strong>: Asked participants to recall as many visualizations as possible.</td>
<td><strong>Long-term Memory</strong>: Two to three weeks after performing tasks using those visualizations.</td>
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<td>Li et al. [34]</td>
<td>Short-term memory</td>
<td><strong>Short-term Memory</strong>: Asked participants to recall as many visualizations as possible.</td>
<td><strong>Short-term Memory</strong>: Five minutes after performing tasks using those visualizations.</td>
<td>15</td>
<td>Bar chart, line chart, and pie chart</td>
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<td>Long-term memory</td>
<td><strong>Long-term Memory</strong>: Asked participants to recall as many visualizations as possible.</td>
<td><strong>Long-term Memory</strong>: Four days after performing tasks using those visualizations.</td>
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What do you think?
Thank You

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