Assessing User Engagement in Information Visualization

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Abstract

Engagement is an important aspect of user experience. We briefly explore the role and significance of user engagement in information visualization, and discuss challenges in its characterization and assessment. We present VisEngage, a self-assessment questionnaire that provides insight into 11 different characteristics of user engagement. We report the results of an online pilot study that was conducted using VisEngage, and reflect on its potential utility for visualization researchers and designers. Future work and research plans are discussed.

For more details please visit the VisEngage website:
https://goo.gl/YnDklo

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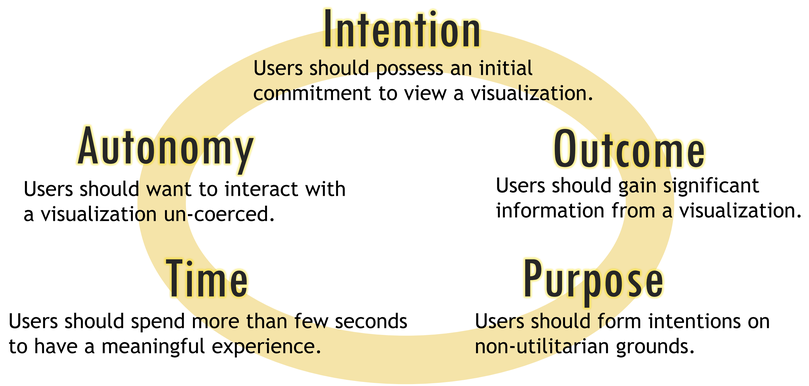
Introduction

Information Visualization (InfoVis) research has historically placed primacy on utilitarian aspects of visualization. Non-utilitarian aspects are becoming more important, as visualizations are becoming increasingly prevalent in everyday, non-work contexts. In this research we focus specifically on user engagement.

Definitions of engagement vary across many domains. After reviewing literature in related areas, while also examining particular characteristics of InfoVis, we propose the following preliminary factors to shape the scope of user engagement in InfoVis:

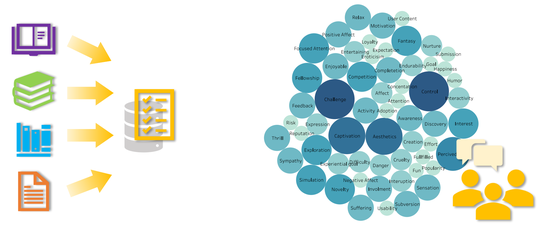


Methods

From the literature, we tried to identify engagement characteristics from related domains.

We merged terms that were too broad or vague. In total, we identified 57 characteristics.

We identified 11 characteristics that had the highest frequency and were most relevant in InfoVis.



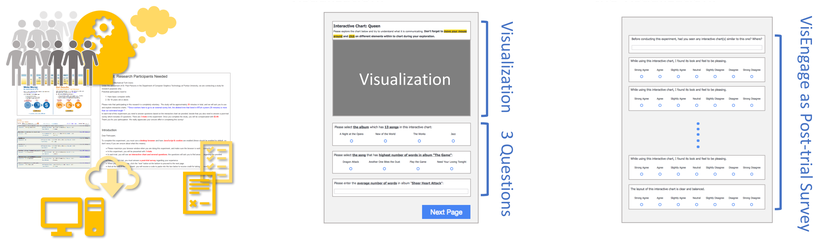
Aesthetics Captivation
Challenge Control
Discovery Exploration
Creativity Attention
Interest Novelty
Autotelism

We identified 22 specific items for the 11 abstract characteristics (2 for each) and compiled them into a self-assessment questionnaire. Participants were presented with visualizations, then provided responses to the questionnaire on a 7-point Likert scale, ranging from strongly disagree (1) to strongly agree (7).

Recruit participants on Amazon Mturk crowd-sourcing platform

Participants answered questions corresponding to the provided visualization.

Participants completed a survey based on their experience using the visualization.



Our experiment had 3 trials. During each trial, participants' interaction data, including total time spent and the length of time a subject's mouse cursor was within the visualization area, was collected.

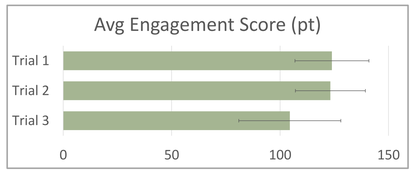
Results

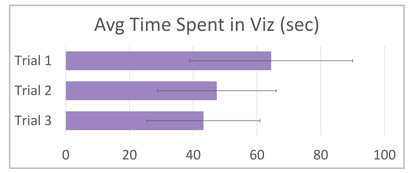
Comparison among three trials

For engagement score, a pairwise comparison revealed significant differences between Trial 1 and 3 ($p<0.01$), and between Trial 2 and 3 ($p<0.01$). For time spent, a pairwise comparison revealed significant differences between Trial 1 and 2 ($p<0.01$) as well as Trial 1 and 3 ($p<0.05$).

Relationship between Engagement score and Spent time

Linear regression modeling of engagement scores and time spent within visualization areas shows low correlation ($R2=0.24$, $F(1, 79)=4.62$, $p<0.05$).

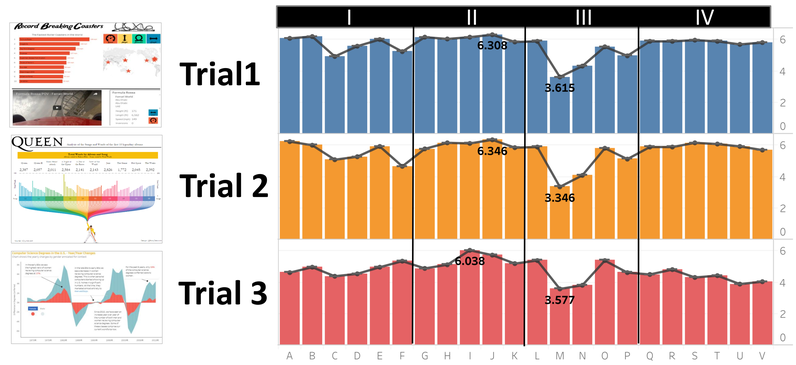




General trend

We can see that items M and N, which deal with the creativity characteristic of user engagement, are considerably lower than the others. Moreover, the chart shape of trial 3 is quite different from others, especially in sections I, II and IV, while Trials 1 and 2 are quite similar—however, we still can identify differences in sections I and IV.

From this pilot study, the first version of VisEngage is capable of identifying the differences across the engagement characteristics on tested visualizations. The next step is to do validation in a more authentic environment to revise and update the questionnaire.



Future Work

For future work, we plan to conduct a laboratory study that can overcome a number of limitations inherent in online studies. We plan to supplement our VisEngage questionnaire with methods such as **eye-tracking, verbal protocol, and mouse tracking**, with the aim of developing a richer and more holistic understanding of user engagement. We will also attempt to mitigate the known difficulties of creating authentic experiences in laboratory settings.