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Exploring user experience in digital libraries through questionnaire and eye-tracking data: a case study of Europeana and dLib

Keywords: user experience, digital libraries, methods, eye-tracking

# Introduction

Evaluation of digital libraries typically focuses on usability measures, such as effectiveness, efficiency, and satisfaction. However, an important aspect of attracting and retaining users lies not only in the performance of the digital library, user friendliness of its interface and the value of its collections, but also in the overall user experience it provides. Encompassing subjective impressions and aspects such as evoked emotions, engagement, and user perceptions of the system, user experience proves difficult to measure (Schrepp, Hinderks, Thomaschewski 2017a). That is probably why these aspects of user experience have so far not been extensively studied in the context of digital libraries.

In the last few years we have, nevertheless, seen the development and publication of several questionnaires that attempt to gain an insight into user experience within the broader context of information systems, websites, search engines etc. This paper wishes to test their usefulness for understanding and exploration of user experience in digital libraries. It also explores ideas on how eye-tracking data could be used to gain a better insight into user experience reported in those questionnaires.

**Theoretical framework**

Based on the use of the term “user experience” in literature, we can see that there is no single view of what user experience is. Many authors use the concept as an umbrella term for all the user’s perceptions and responses, measured subjectively or objectively (Bevan 2009) and typical report usability issues and measures when talking about user experience. In this paper, however, we take the narrower view that defines user experience as individual's perceptions and reactions based on the interaction with the system. These include the perceived pragmatic quality of the system (perception of effectiveness, usefulness) as well as the so called hedonistic qualities (fun, enjoyment, evoked emotions etc.) (Hassenzahl 2005; Mahlke 2008).

In digital library evaluations, the hedonic qualities have often been overlooked. The most promising work, reporting on the development of a Digital Library User Experience Scale (DLues), was published as early as 2004 (Toms, Dufour and Hesemeier 2004). The scale included nine indicators such as visual appeal, entertainment, escapism, intrinsic enjoyment, excellence, and novelty, however, no further publications were made and the scale was not published online to be tested by other researchers. A study of Europeana pointed out eye-tracking as a valuable method to gain an insight into users’ interactions, search behavior as well as usability problems in the context of digital libraries (Sykes et al. 2010). The study included eye-tracking data as well as an analysis of user behavior and feedback through first impressions, deeper impressions and lasting impressions (Dobreva et al. 2010), which could be characterized as user experience measures. But the eye-tracking data seems to have been used mainly to identify and understand potential problems with specific parts of the user interface.

**Research questions and methodology**

With the goal to explore the potential usefulness of questionnaires and eye-tracking data for evaluating user experience in digital libraries, we posed 3 main research questions:

* What can we learn from standardized questionnaires about user experience in digital libraries?
* How does the user experience in digital libraries compare based on questionnaire data?
* How could eye-tracking data be used to compliment or explain the results collected from user experience focused questionnaires?

To address the questions, we carried out a study in May and June 2019, using a convenience sample of 30 participants (16 female and 14 male), all students from various programs at the Faculty of Arts, University of Ljubljana. Two digital libraries with a range of cultural heritage items from written texts to photographs were selected for the experiment: Europeana, a well-known international digital library, and dLib, a national digital library. All the sessions were recorded using Tobii eye tracker to follow the gaze patterns and interactions of the participants with the two digital libraries.

The study was designed as a within-subject experiment, where each participant completed the given task with both digital libraries and the order of the two libraries was rotated. After completing an exploratory task to find and select a photo from the First World War in each library, participants were presented with a questionnaire to report on their user experience in that digital library and their previous experience with the system.

Choosing among several existing questionnaires that focus on user experience, we selected a short version of User Experience Questionnaire – UEQ (Schrepp, Hinderks, and Thomaschewski 2017b) and the Emotion word prompt list – EWPL (Petrie and Precious 2010) as both tools focus on the core user experience concepts: perceptions of the system (UEQ) and the emotions evoked during and after the interaction (EWPL).

**Research Results**

For the completion of the search task, participants needed on average 76 seconds in Europeana and 89 seconds in dLib. Despite the fact that both digital libraries are relatively well known, this was the first interaction with Europeana for almost all participants (29 out of 30) and the first interaction with dLib for more than half participants (17 of 30) - only 2 participants used dLib on regular basis.

The results of both questionnaires clearly show that participants experienced their interaction and the system more positively in Europeana compared to dLib. Further analysis also revealed that interacting with two systems influenced participants’ experiences in a particular way: in both questionnaires, dLib received lower scores when it was displayed second (after Europeana) then when it was displayed first. On the contrary, Europeana received higher scores when it was displayed second (after dLib) compared to when it was interacted with first.

The differences between the two systems can be additionally explained by the UEQ analysis tool, which shows that, according to UEQ scores, the biggest difference between the two systems lies in the hedonic qualities of the system. Benchmarking the two systems with the UEQ scores from numerous other tests puts the results in a wider perspective, labelling Europeana scores as good and above average while dLib scores are below average and bad.

**Discussion**

There are certain shortcomings in the design of the study, such as a short interaction time with the system, a laboratory environment with a predefined task, and a question of reliability of self-reported scores when it comes to emotions and perceptions. However, the main focus of the study lies in the exploration of the tools for assessing user experience and despite the differences in focus and types of questions, both questionnaires showed a more positive experience in one system over the other. Further analysis of the different dimensions and aspects of user experience covered in the questionnaires can provide some answers, but cannot really give explanation as to why users felt a certain way about the system or what features of the system evoked negative or positive experience. Thinking of how to take advantage of eye-tracking data to provide such answers, we will further analyze the data to see if we can connect certain eye-tracking measures to emotions and perceptions captured in the questionnaires, for example:

* longer fixations on certain elements to participant’s feeling of being *unsure*, *interested or curious;*
* regressing saccades to *confusion;*
* time spent on the task to the feeling of being *pleased/frustrated* and the perception of the system as *easy* or *complicated*.

Exploring connections between questionnaire data and the specific user interface elements and where fixations occurred or eye movements could also provide additional insights into user experience in digital libraries.

**Conclusion**

User experience presents and interesting and important area of research also (or especially) for digital libraries. It can provide an insight into how users perceive and experience their interaction in digital libraries and help us identify elements that are important to provide a positive user experience that will engage and attract users. This study shows only one example of how existing tools and methods can be used and what kind of information they can provide. Therefore further studies with different tasks, different questionnaires and methods are needed to find those that would be most useful in the context of digital libraries.

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