Designing User-Centered Mobile Wayfinding Application for Library Indoor Navigation

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Abstract
Library users frequently confront difficulties in navigating through the library complex to find different formats of resources and services they seek. The rapid adoption of mobile technology made it possible to improve the efficiency and effectiveness of a wayfinding process. Incorporating users’ interests and preferences into the design procedure of a wayfinding application is an imperative task for developing library indoor navigation tools. With applying mixed research methods and innovative data collection technique (e.g., recording users’ interactive behavior on smartphone) to examine sixteen (16) smartphone users’ interaction with a wayfinding application on an academic library website, the authors identified a series of important usability problems existing in a wayfinding application, discovered users preferred interactive features, and proposed new labeling and navigation systems of such a kind of wayfinding application.

Keywords: wayfinding application; indoor navigation; mobile design; card sorting; information architecture

1 INTRODUCTION

With the rapidly growing collections and services in academic libraries, library users frequently confront difficulties in navigating through the library complex to find various formats of resources and services they seek. The rapid adoption of mobile technology with its unique advantages in portability, ubiquity, and wireless capabilities (Hahn, Twidale, Gutierrez, & Farivar, 2011) has been considered a promising approach to addressing this issue by guiding users to their intended destinations independently.

To accommodate the rising needs of mobile device users, an increasing number of library websites have recently been converted to a responsive design (allowing a single site to automatically adapt to multiple screen sizes). Thus, it is worthwhile to investigate what kind of interactive wayfinding system is suitable to the responsive design of library websites. Brigham Young University (BYU)’s Lee Library website recently migrated to the responsive design model, but very little modification was made to its wayfinding tool—a floor map application (See Figure 1).
This application has been in use for several years and only minimal changes were made to accommodate the library site's new responsive design. Thus, we implemented a study to examine users’ information navigation behavior and their interests and requirements for a wayfinding system that is suitable for the BYU library's responsive design website. Findings of this study will have significant impact on reducing the number of wayfinding questions asked at the reference (help) desk, reducing patron time in finding items, and improving the design of library spaces (Lee, Kim, & Platosh, 2015; Mandel, 2010). In brief, this study aims to answer these two questions:

RQ1: Is the design of the current wayfinding system (floor maps tool) cognitively effective to facilitate library users' wayfinding needs? What features do users prefer to have in a wayfinding system?

RQ2: How should the primary and secondary navigation systems of a wayfinding tool be structured to accommodate users' mental models?

2 METHODS

Sixteen (16) university students were recruited to participate in this study. Think-aloud interview and online card sorting methods were used to collect data at a library classroom. Two types of smartphone users were included: undergraduate students (8) and graduate students (8). During a think-aloud session, individual participants were asked to use the current BYU library floor maps tool to locate different types of places or resources (e.g., books, study rooms, the Research & Writing Center, library elevator) while continuously thinking aloud their actions and articulating problems they were encountering. Eight search tasks were designed to uncover the usability issues of the current floor maps tool. Think-aloud commentary, user facial expressions, and phone screen movements were recorded with a combination of Quicktime and Silverback software running on a Mac laptop computer. At the end of each think-aloud session, subjects were invited to participate in a semi-structured interview to share their overall thoughts on their interactions with the system. The recording video sessions were analyzed with Morae Manager 3.2. The relevant parts of the recorded sessions were transcribed and analyzed further. Data analysis included reviewing the recorded sessions, coding the contents for occurring themes of user requirements, and identifying usability issues across the two user groups.

In addition, a card sorting method was employed to discover user preferred menu structures or navigation paths. Optimal Sort (http://www.optimalworkshop.com/), an online card sorting tool, was used to let 16 participants group 50 cards representing menu items of the floor maps application into different categories. Overall, it took each participant 30-45 minutes to complete the think-aloud interview and card
3. RESULTS

3.1 RQ1: Is the design of the current wayfinding system (floor maps tool) cognitively effective to facilitate library users’ wayfinding needs? What features do users prefer to have in a wayfinding system?

The results indicated that users across the two groups encountered similar usability issues when they employed this floor map application to locate a variety of resources, services, and locations. Major usability issues identified from the think-aloud interviews include:

- Current organization and labeling systems (e.g., menu categories like “Help Desk”, “Call number”, “On this Floor”, and “Other locations”) in the global navigation area do not match users’ mental model effectively. For instance, “Other Location” tab is an ambiguous tab that made many users’ search attempts fail. Some users felt that “Research and Writing Center” should be a menu item located under the “Help Desk” tab, but it is actually placed under the “Other Location” tab.
- Current interactive features of this wayfinding system have limited support for users’ control on a mobile device. For example, most students recognized the floor switch function, but the narrow space between floor switch arrows made it difficult to select the correct one.
- Current taxonomies of the navigation system are narrow and deep, so users have to scroll down a long list of menu items to find what they are looking for.
- Visual cues (e.g., icons) on the floor maps are not always intuitive to users. Some graduate students were not sure about the elevator icon on the map. They suggested providing textual annotation for an icon such as “Here is an elevator”.
- The current search engine is not intelligent and powerful enough to allow the entry of a user-defined query. For instance, when users searched for “mystery novel” or “mystery fiction” no search results were returned. Users had to search “mystery” or “popular reading” to locate mystery novels.
- Users were not sure what was searchable in the search box. The textual prompts in the search box (Search call/room #s) were misleading. Users got a wrong impression that the search box can only search call and room numbers.

The think-aloud interview process also revealed users’ preferred features of a wayfinding system such as: 1) employing finger gestures to examine details on a map (e.g., pinch, zoom in and out); 2) searching specific information (e.g., room number) in search box; 3) being informed about their current locations; 4) being aware of the functions of different library locations etc.

3.2 RQ2: How should the primary and secondary navigation systems of a wayfinding tool be structured to accommodate users’ mental models?

Card sorting data analysis examined all categories formed by users. After standardization of the categories, we identified four predominant categories formed through the users’ card sorting process:

- Help Centers
- Rooms/Galleries
- Library Services
- Other

Based on the frequency of users’ agreement on placing cards in one category, we found users’ preferred menu items under each aforementioned category. Then we used the similarity matrix and standardization grid (See Figure 2 and Figure 3) to verify the relationship between a menu item (cards) and a menu tab (categories). At last, we formed the newly proposed navigation and label systems (See Figure 4) for the floor maps application.
Figure 2: Similarity matrix of card sorting data
Figure 3: Standardized grid of card sorting data
4. CONCLUSION

Labeling and organization systems of a library wayfinding tool are often created from library internal staff’s perspective. As a result, a discrepancy between designers’ and users’ mental models exists which eventually leads to difficulty in using these applications. To design usable wayfinding applications, we need to investigate the mental models of content labeling and the organization schemes of real users. In this study, we employed a mix of user research and analysis methods (Think-Aloud Interview & Card Sorting) to gain insight into the preferred information architecture of a wayfinding application according to users. We identified new categories (e.g., Library Services, Rooms/Galleries) that users would like to employ to navigate a floor maps tool. We also discovered how users interact with a wayfinding application to quickly identify location information.

5. REFERENCES