Mobile Design Usability Guidelines for Outdoor Recreation and Tourism

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Abstract. Information-intensive websites such as those for outdoor recreation and tourism present complex design considerations and issues that need to be researched for mobile access. To gain a better understanding of the expectations and desires of users regarding a mobile application for outdoor recreation, researchers created a mobile application prototype for the US Army Corps of Engineers, which was subsequently tested for usability at two recreation sites in Kentucky with local participants. We provide an overview of our methods and results, and best practices we have gleaned from our findings. Our research is especially applicable for mobile applications that require access to a large amount of information and for a broad audience, and we also hope our study encourages more research in these areas.

Keywords: Mobile applications, mobile interfaces, usability, outdoor recreation, tourism, public websites.

1 Introduction

The popularity of mobile devices and applications has continued to explode, and the number of US adults who own smartphones has increased from 35% in May of 2011 to 56% in May of 2013 [1]. Outdoor recreation participation has been increasing steadily since The Outdoor Foundation began documenting participation in 2006, with 141.9 million participants in the United States getting outdoors in 2012 and "an average of 87.4 outings per participant for a total of 12.4 billion outings overall" [2]. The most popular activities included running, bicycling, fishing, camping, and hiking.

With the ever-climbing popularity of mobile devices and applications and the widespread and steady interest in outdoor recreation, comes the need to provide recreation and tourism information via mobile devices. However, currently there is a lack of mobile guidelines or standards based on research, especially for applications or websites that need to provide a large amount of information to a broad audience.

The Corps Lakes Gateway (CLG) website provides an enormous amount of information about US Army Corps of Engineers outdoor recreation resources for visitors. The CLG website (Fig. 1) received over 47 million hits in 2011, showing the

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desirability of this information. The Corps' 422 lakes in 43 states receive 370 million visits a year. To enhance the experiences of visitors and increase public interaction with the Corps, our aim was to create a mobile application to meet the growing expectation and need of the public for interactivity at their fingertips at all times.

Fig. 1. US Army Corps of Engineers, Corps Lakes Gateway website homepage

To learn what types of features and information users expected for this mobile recreation application, we first conducted the following studies, with each subsequent study using and building on the findings of the previous:

1. Meta-review of existing parks and recreation mobile applications to analyze the content and common features of over 50 applications, and to select representative interfaces.
2. Usability-based focus group in which participants rated the importance of potential features and discussed several alternative designs.
3. Survey of mobile mock-up designs asking participants to rank designs by choosing among three different designs for each type of page.

The results of these studies were then used to create a CLG mobile application prototype, which was usability tested at two US Army Corps of Engineers (USACE) projects: Green River Lake and Nolin River Lake, Kentucky, in June of 2013. The goal of this study was to identify user interface issues with the CLG mobile prototype in order to improve the user experience and generate research-based mobile interaction design best practices.

1.1 Related Work

Given the growth of mobile devices and application use, there is a critical need for a set of standards specifically for mobile interaction design based on research. Guidelines have been provided for iOS and Android for developers using these platforms to employ consistent design, yet these often "do not make recommendations for mobile

websites, which run on different kinds of operating systems" [3]. Other guidelines have begun to emerge with practitioners and researchers working to bridge the gap between established web standards and standards for mobile. For example, Shneiderman's "Golden Rules of Interface Design" have been applied to mobile usability [4], and Nielsen's five attributes of usability [5]. Additionally, Wroblewski's mobile design strategies are based on real-world projects [6]. However, these efforts demonstrate the need for mobile's own set of standards for usability.

Research on the usability of mobile devices, websites, and applications has and is being conducted, but the majority of this testing has involved controlled experiments [5], most in a lab setting. This type of testing can be problematic, as it can limit the research by not capturing contextual cues and issues that could be found in a field study [7]. Therefore, in our study we moved outside of the lab and conducted usability testing at two outdoor recreation locations (campgrounds and boat launches) with a variety of recreation users to increase the ecological validity of our findings and preserve the context in which this mobile application would be used.

Nielsen and Budiu have recently offered strategies and guidelines for mobile usability, such as the need to focus the attention of users only on the essential content [9]. However, the amount of information that needs to be represented on a recreation or tourism mobile application leads to the issue of what is essential content for these types of users. Research for information-intensive mobile websites and applications is needed, and therefore to increase the validity and accuracy of the results of our studies for this issue, we used multiple methods throughout our design process [10].

2 Evaluation Scope

The goal of this research was to identify usability issues with the CLG mobile prototype and develop best practices for designing mobile user interfaces based on these findings. Usability refers to how easily a specific task can be accomplished with a specific tool. More verbosely, the International Organization for Standardization (ISO) defined usability as the "extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use" [11]. Effectiveness is defined as "accuracy and completeness with which users achieve specified goals," efficiency is defined as "resources expended in relation to the accuracy and completeness with which users achieve goals," and satisfaction as "freedom from discomfort, and positive attitudes towards the use of the product." While other conceptualizations of usability have been proposed [12-14], the ISO definition is the most widely accepted and was used by the research team.

2.1 Evaluation Metrics

Usability was evaluated in terms of its three constituent components: effectiveness, efficiency, and satisfaction. Effectiveness was measured as the percentage of tasks completed successfully. Efficiency was measured as the average time to perform a task and assessed based on issues observed during performance of the tasks. Satisfaction was measured by post-task questionnaires, post-study questionnaire, written feedback, and verbal comments during the session. While effectiveness and efficiency measures were quantitative, satisfaction was measured qualitatively.

2.2 Evaluation Strategy

Testing was designed to answer the following questions:

- What do users like and dislike about the flow of the CLG mobile prototype, e.g., navigation, organization of task flows, and grouping of content?
- What aspects of the user interface are hard to understand?
- What aspects of the process need to be enhanced?

Tasks designed to address these questions were developed by the project team, which consisted of researchers with experience conducting visitor studies in park and outdoor recreation settings and performing user-focused evaluations. The tasks pertained to three phases of a typical recreation trip: pre-trip planning, on-site activities, and post-trip reflection and feedback. The mobile application tested was not "live," since these rural locations have little or no internet connectivity. However, its basic functionality and several levels of screens tied to actual project data were made available to Corps recreation visitors for evaluation.

Participants consisted of a convenience sample of visitors who were recruited at two Corps of Engineers lakes in Kentucky: Green River Lake and Nolin River Lake, with the permission of the park managers. To maximize diversity in the sample, the Corps managers advised the research team of two campgrounds (one at each lake) where the team was likely to encounter a fairly large number of visitors who would be participating in a variety of outdoor recreation activities.

2.3 Procedure

The research team occupied a campground site and set up the data gathering station (Fig. 2) consisting of a table, tablet computer with mobile app mock-up and recording

Fig. 2. Data gathering station with participant, research team member, tablet with mobile application, and recording devices

software, video camera for recording tablet usage, and umbrella to darken the screen for ease of viewing in a bright, outdoor setting. Visitors were recruited by walking around the campground and asking for volunteers, who would receive $25 compensation for the 30-minute sessions. After reviewing and signing the consent forms and filling out a demographic questionnaire, participants performed up to nine tasks and filled out a post-study survey on-site about their experience with the mobile application prototype. Both audio and video recordings of the interviews were made using TechSmith's Morae® (v3.2.1) software.

In the Usability/Accessibility Research and Consulting research lab at Michigan State University, two independent reviewers, working with written observation notes, reviewed the Morae recordings to transcribe relevant user quotes, compute task completion times, and record difficulties and successes in completing the tasks. This analysis was verified by the principal investigators and discussions with the independent reviewers took place to resolve any differences in interpretation of the data.

2.4 Participants

Twelve participants, six females and six males, took part in the usability testing of the prototype at Green River and Nolin River Lakes (with 6 users participating at each site). Participants' ages ranged from 19 to 72; five participants were between 18 and 30 years old, two were between 31 and 40 years old, and four were between 51 and 80.

3 Usability Results

Participants attempted up to nine task scenarios using the CLG mobile prototype (Fig. 3). The tasks focused on finding information using the application, such as directions to the park, weather forecast, activities at the lake, and where to leave feedback. Participants were also asked whether they would use the mobile application and for what purposes to determine what additional information users would like.

Participants were mostly or entirely successful on 4 of the tasks, somewhat successful for 2 of the tasks, and encountered difficulties with 3 of the tasks. In general, participants were able to find the lake and lake area pages (e.g., Nolin River Lake is divided into 9 recreation areas), but they often had trouble finding more specific information in the lower layers of the application, such as the status of boat ramps at a lake (i.e., closed/open) and information about special events at the different recreation areas.

Even though several participants encountered difficulties finding some of the information and completing tasks successfully, the majority of participants provided positive feedback and expressed interest in using the application in the future. They also gave a variety of suggestions for enhancements and information they would like to be added to the application, which are being used for revisions to the prototype.

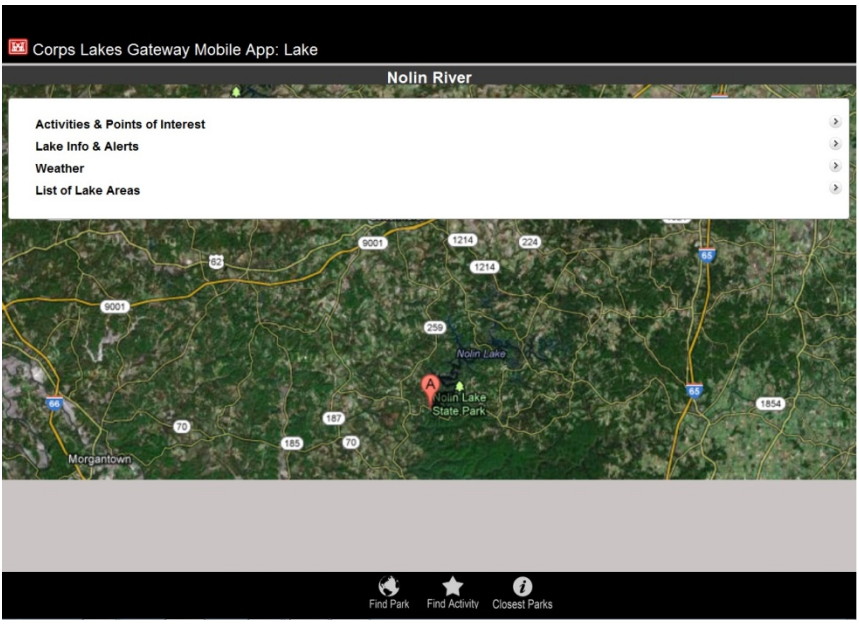

Fig. 3. Corps Lakes Gateway mobile prototype, Nolin River Lake page

4 Best Practices Based on Observations and Results

Usability testing of the mobile application prototype, with our observations and feedback from outdoor recreation users in the field, provided results consistent with other mobile studies, such as:

- Clear navigation is needed at the bottom of the screen
- Minimal scrolling should be needed; pages should be visually easy to scan
- Clickable features should have large clickable areas
- Fewest number of clicks needed to reach information
- Accurate and expected titles for pages, buttons, etc. should be used
- Links, buttons, etc. should be spaced to allow for easy clickability

Our usability testing also provided unique findings, specific for an outdoor recreation or tourism application for a broad range of users:

- Many outdoor recreation locations have weak or no wireless signals, and therefore users need the ability to download a static or cached version of the application.
- Options to access weather and a general search feature do not necessarily need to be custom made or contained within this type of application, as users often already have a preferred resource for this type of information.
- Environmental conditions, particularly sunlight, need to be considered. Font size and contrast should most likely go beyond typical standards to increase readability in the environment and also serve a diverse audience.
- Separate applications should be developed for smartphones and tablet devices in order to meet differences in size and user expectations.

5 Conclusion

Researchers created and evaluated a mobile application prototype for the US Army Corps of Engineers at two recreation sites in Kentucky with local participants. Research-based mobile field testing revealed best practice user interface design guidelines especially applicable for mobile recreation applications that require access to a large amount of information and diverse audience in outdoor settings.

The use of multiple methods in usability research, while not unique, is infrequent but highly recommended. Particularly, the combination of qualitative and quantitative procedures applied to participants in situ enhances the validity of results in contrast to single-method evaluations.

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