

Designing for Success: Creating Business Value with Mobile User Experience (UX)

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Abstract. The popularity of mobile devices, such as smart phones and tablets, provides both new opportunities and challenges for companies. Mobile devices allow companies to reach users anywhere, anytime; however, these devices present the challenge of designing websites that can adapt to smaller screen sizes. Because competition is shifting more and more toward user experience, creating a positive mobile experience is becoming increasingly important in maintaining a competitive edge in the market place. To address this issue, we measured the user experience of an actual e-commerce website before and after it was optimized for mobile devices and used Google Analytics to follow user behavior. The results suggested that optimized websites are likely to have a major positive impact on the ROI for a company.

Keywords: User Experience Design, Mobile Websites, Mobile Optimization, Mobile User Experience, Return on Investment (ROI), Business Value, Google Analytics

1 Introduction

Online browsing via mobile devices is becoming increasingly popular [7]. Last year alone in the US, there were more than 100 million smart phones users and more than 60 million tablet users. The population of mobile device users is expected to grow substantially in the future [4, 5]. People use mobile devices because they can provide a quick and easy way to access the Internet [7]. This fast and convenient access to information, in turn, is likely to have a major impact on consumer behavior. For example, using a smart phone can not only make it convenient to search for a product anywhere, anytime but can also make it quite easy to compare products at various stores and/or arrange follow up activities such as visiting the store or calling for additional information.

Consumers' fast and convenient access to information via mobile devices provides new business opportunities for companies. It allows companies to reach a broader

consumer base. The opportunity to reach consumers via mobile devices, however, presents companies with some serious challenges as well. In order to reach customers anywhere, anytime companies need to develop websites that can be accessed effectively via various devices. Lessons learned from research shows that staying competitive in the market place requires companies to provide superior user experience for their websites [2, 3, 10]. While designing websites for various screen sizes has been one of the major topics in web development circles [8], little work has been done to look at mobile user experience with a business lens.

The objective of this research is to take a basic step toward examining the value of mobile user experience from a business point of view. In order to achieve this goal, we conducted two user studies to track changes in mobile experience and utilized web analytics to track changes in behavior after the website was optimized for mobile devices.

As customary in industry research, first we assessed the current state of mobile experience via an initial study to identify whether there were any opportunities for improvement, and if so, identify changes that would be most impactful [11]. This approach is crucial in practice for two important reasons: 1) it allows companies to benchmark experience before implementing changes, and 2) it facilitates data driven experience design should the process identify opportunities for improvement.

Next, we optimized the website based on the results obtained from the initial user experience study. Then, we conducted a second user experience experiment centered around the same task and settings. This arrangement allowed us to directly assess the impact of optimization on users' subjective experience of the mobile website.

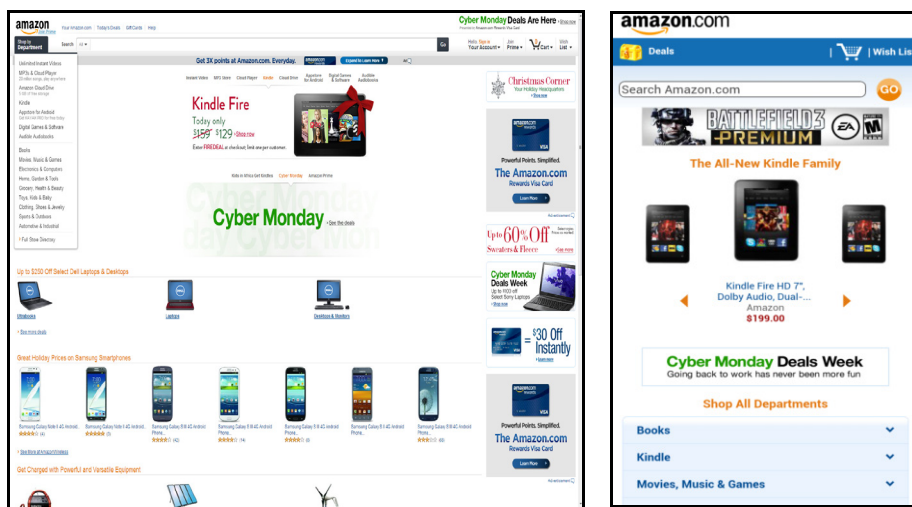
Companies often use web analytics to estimate the business value of their user research and to plan their future research efforts [6, 11]. Because we were interested in the business value of user experience, we used Google Analytics to see whether there were any improvements in mobile traffic and sales after the website was optimized for mobile devices.

The results of the user studies as well as the results of Google Analytics are discussed in the following sections.

2 Background

Mobile optimization supports the "One Web" recommendation of the World Wide Web Consortium (W3C), which advocates that users should be able to receive the same service and information regardless of the type of device they are using. While W3C's One Web concept emphasizes the accessibility of information irrespective of the medium used, it does not require the provided information to have the same representation across various devices. This is both helpful and necessary for mobile optimization. To explain this better, Figure 1 shows amazon.com's website accessed

via a desktop computer and a mobile phone. As shown in Figure 1, while both devices provide access to the same content they differ in how they represent information. Due to the smaller screen size, the mobile website has to adjust its content to fit the smaller screen of a mobile phone. The visual attributes of the content on the mobile screen are also modified to create an appropriate visual balance for the smaller screen. The original visual structure is adjusted so that the page can convey the same hierarchy of information on a smaller display [3]. The navigation bar, links, and menu on the mobile site are also modified to occupy less visual space.



1a: Amazon.com displayed on a desktop

1b: Amazon.com displayed on a smart phone

Figure 1: Example of an optimized mobile website

3 Measuring the Mobile UX

3.1 Study I: Benchmarking the Mobile Experience

The objective of this study was to assess the experience of a mobile website and to identify possible opportunities for improvement. In order to do so, we used an actual e-commerce website. We conducted our investigations in a laboratory setting to facilitate a controlled environment for observing and measuring user experience.

3.1.1 Task

To avoid user fatigue, we focused on testing the mobile experience of the purchasing process on the website. The task required users to look for a specific product on the e-commerce website and complete the checkout process for that specific product.

3.1.2 Measurements

We used the System Usability Scale (SUS) [1] to measure a user's subjective experience of the website. SUS captures a person's evaluation of interaction with a product via a 10-item questionnaire. This instrument is widely used in industry research to assess website experience [9]. Compared to other frequently used instruments in industry research, such as Questionnaire for User Interaction Satisfaction (QUIS), Computer System Usability Questionnaire (CSUQ), and Microsoft's Product Reaction Cards, SUS is more sensitive in detecting differences in smaller sample sizes [12]. SUS provides a simple method for converting the results of the questionnaire into a single value, which can be used to compare webpages [9]. These SUS values can range between 0 to 100, with 0 indicating the worst and 100 indicating the best attainable score. To achieve an above average user experience, a minimum SUS score of 68 is recommended [9]. In addition to SUS scores, we also used observation and post task interviews to assess user experience of the mobile website.

3.1.3 Participants and Design

Seventeen graduate and undergraduate students (10 male, 7 female) participated in the study. All participants were expert web users who accessed the Internet via mobile devices on a regular basis. Participants were asked to look up and complete the purchasing process for a specific service offered on the e-commerce website. For the purpose of the experiment, a test account was created (username and password) to be used by all the participants. All participants used the same fictitious information (e.g., credit card number and expiration date) to make the purchase with the test account. The study was conducted on a Samsung Galaxy S3 smartphone running Android 4.0.4, and an Apple iPhone 4S running iOS 5.1.1.

3.1.4 Results

Our analysis did not show any significant quantitative differences in scores between the two mobile devices, therefore we used the pooled data to assess the user experience of the website.

The results of surveys, observations, and interviews all indicated an opportunity for improvement. For example, the survey results showed an average SUS score of 57,

which is below the recommended threshold for an above average user experience [9]. The interviews and observations confirmed the SUS results indicating an opportunity for improving the user experience of the mobile e-commerce website. In particular, the observation and interview data showed that the following changes would have the most impact on the user experience of the mobile website: 1) minimizing “pinch and zoom” interactions, 2) minimizing horizontal scrolling in a way that the content fits the screen appropriately, 3) minimizing redundancies so that the content fits the screen without creating clutter, and 4) using an optimized menu to minimize the visual space required for navigating the website and to facilitate an easy way to move between webpages.

3.2 Study II: Assessing the Impact of Modifications on Mobile Experience

The objective of this study was to examine the impact of mobile optimization on user experience. Thus, before conducting this second experiment, we implemented the improvement opportunities that were identified in the first study. We used the Cascading Style Sheets specification (CSS), a web styling computer language to format the content of the webpages. In addition to formatting the content, we also changed the structure of the content to minimize “pinch and zoom” interactions. This also ensured that the content would fit appropriately on the screen of a mobile device, thereby eliminating the need for horizontal scrolling. We also removed redundancy in the content to minimize clutter and/or the amount of scrolling needed to see below the fold of the page, and modified the structure of links and menus to optimize the use of available visual space.

3.2.1 Task

We used the same task (purchasing of a specified product) that was tested in the first laboratory experiment.

3.2.2 Measurements

As in the first study, we used SUS to measure the subjective experiences of the participants in our study. We also used observation as well as interview data to examine user reactions to the website.

3.2.3 Participants and Design

As in the first experiment, participants were recruited from a pool of graduate and undergraduate students (27 participants, 19 male and 8 female). As in the first experiment, the study was conducted on a Samsung Galaxy S3 smartphone running Android 4.0.4, and an Apple iPhone 4S running iOS 5.1.1.

3.2.4 Results

Again, our analysis did not show any significant differences between the two mobile devices and therefore we pooled the data to evaluate the user experience of the website. Our analysis showed a major improvement in SUS scores (SUS=73), a score well above the recommended threshold for an above average positive experience (SUS=68). We ran a t-test to see whether the observed SUS scores in the two studies were significantly different. The results of the t-test showed that the user experience captured via the SUS score was significantly improved after the website was optimized for mobile devices (Table 1). The observations and interviews also confirmed this improvement in experience.

Table 1: SUS scores before and after mobile optimization

	Mean	SD
Before optimization	57	23.34
After optimization	73	21.28

t=2.25, df=40, p=0.03

4 Google Analytics

Companies often look at web and sales analytics before and after they change their websites to estimate the business value of their usability improvements [6, 11]. Similarly, we looked at the website traffic and transaction volume of the e-commerce site before and after it was optimized to see if there were any changes in consumer behavior. In order to measure web traffic, we looked at Unique Page Views and Bounce Rate. The former represents the aggregated page views of a single user during the same session. The latter refers to the percentage of visits in which the user views only one page on the website before exiting the site. Lower levels of Unique Page Views and/or higher levels of Bounce Rate could indicate a lack of engagement with the site. We also looked at Quantity Sold, which refers to the total number of items sold for a product.

We tracked mobile traffic for the same pages that were used in Studies 1 and 2. Additionally, we compared user behavior 12 months before and 12 months after the e-commerce website was optimized for mobile devices. While, we noticed improvements for shorter periods (e.g., three months before and after the launch of the new website), we used a 12-month period to account for seasonal differences that may have an impact on consumer behavior.

Table 2 shows the percentage of change over a period of 24 months, comparing user behavior 12 months before and 12 months after the e-commerce website was optimized for mobile devices. As shown in Table 2, after pages were optimized for mobile devices, the number of times these pages were viewed by visitors increased by

40% and number of visitors who did not leave the site after viewing the first page doubled as evidenced by a 50% decrease in the Bounce Rate. The results displayed in Table 2 also show a 31% increase in the sales quantity of the specific product that was the focus of examination in our user experience studies. These statistics are consistent with the results of our user studies, which showed significant improvement in SUS scores, from 57 before optimization to 73 after optimization for mobile devices.

Table 2: Changes in user behavior before and after mobile optimization

Unique Page Views	41.31% increase
Bounce Rate	50.00% decrease
Quantity Sold (the product examined in Study 1 and 2)	31.10% increase

5 Discussion

A growing body of research acknowledges that paying attention to user experience plays a major role in business competition. However, little work has been done to look at mobile user experience from a business point of view. A major objective of this study was to look at user experience through a business lens.

Our results show that optimization can have a significant impact on how users experience a mobile website. Study 1 and Study 2 provide evidence that mobile optimization facilitated a statistically significant improvement in experience (from SUS=57 to SUS=73). The improvement in user experience was supported by Google Analytics comparing consumer behavior a year before and a year after the website was optimized for mobile devices. While improvements in user behavior were evident shortly after the implementation was completed, we used a 12-month time period to control for possible seasonal differences. These results showed about 40% increase in Unique Page Views and 50% decrease in Bounce Rate. Because both of these metrics could be associated with user engagement, an impressive increase in Unique Page Views along with a substantial decrease in Bounce Rate could indicate increased engagement, which in turn could indicate that optimization had a major positive impact on how users viewed the pages.

The results also showed over 30% increase in sales of the product that was under investigation in this study. While assessing the impact of optimization on the entire product line was outside the scope of this project, it is important to note that Google Analytics showed an impressive improvement (over 70% increase) in quantity of all products sold over the mobile optimized site.

While the results of our laboratory study cannot be directly linked to the results of web analytics, the fact that both user studies and Google Analytics showed significant improvements after the website was optimized make a compelling case for the business value of mobile user experience.

6 Limitations and Future Research

As with any investigation, the results reported in this study are limited to the setting and the task. For example, the investigation in Study 1 and 2 were conducted in a laboratory setting and the task used in the study was limited to a specific website and a specific product. However, to minimize threats to external validity, we used an actual live website and an actual product to conduct our investigations. Our laboratory experiments had also a relatively small sample size, which can affect the chances of finding statistically significant differences. However, our results showed significant differences in user experience before and after the website was modified. While these results suggest the possibility of a large effect size, future studies using different tasks and settings are needed to increase confidence in the generalizability of the findings.

We used web analytics to look at the value of our mobile optimization through a practical business lens. While user experience is an important factor in website traffic and/or product sales [2, 11], factors other than user experience (e.g., promotions) can also influence traffic and sales. To minimize the impact of such effects we compared traffic and sales statistics for a longer period of time (12 months) before and after the changes were made to the websites. Nevertheless, care must be taken when generalizing the results.

6 Contribution

While additional research is needed to increase the generalizability of the findings in this study, the results of the laboratory experiments in our study show that mobile optimization can have a significant impact on the user experience of a website. The results of Google Analytics suggest that mobile optimization is likely to help increase traffic and sales volume of mobile e-commerce websites. Thus, this study contributes to the HCI literature in three ways: 1) it establishes the importance of mobile optimization in improving the user experience of a mobile website, 2) it looks at user experience from a business point of view, and 3) by doing so, it highlights the value and significance of user experience research in theory and practice.

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