

User-Centered Design in a Time Crunch: A Case Study in Developing a Mobile Grocery Shopping Application

Josh Fridgen

Department of Computer
Science/Information Systems
College of Saint Scholastica
Duluth, MN 55811

jfridgen@css.edu

ABSTRACT

User-centered design is an important consideration in the technological world today, and exploring its implementation in various areas and situations is important. This case study addresses this in two ways. On one hand, it is meant to evaluate how user-centered design can be used in developing a mobile application, particularly, a grocery shopping application. On the other hand, it is meant to observe how user-centered design can be applied to a project with serious time constraints, in this case, less than three weeks. This paper introduces user-centered design, describes the implementation of the case study, and explains conclusions that were drawn.

Keywords

user-centered design, mobile applications

1. INTRODUCTION

In short, user-centered design (UCD) is focusing on the user throughout the entire process of creating a product. The user, also known as customer, learner, and human, is simply a person who might use the product [9]. From the earliest stages of planning, throughout development, and even after deployment, satisfying the user is the top priority. The user is continually referenced throughout this process and user requirements are constantly refined and evaluated against the product.

IBM is one major organization that has had success with UCD and has contributed to and enhanced its process. Members of this organization have identified six major principles essential to UCD: set business goals, understand users, assess competitiveness, design the total user experience, evaluate designs, and manage by continual user observation [3]. Assessing competitiveness is a less obvious, but important, UCD principle. The competition becomes clear by understanding users and how they currently accomplish tasks. It is a major consideration in the design process and is regularly tested against to ensure the new product will offer a better solution.

Another way to describe UCD is to focus on three methods used to support it. The first method is user needs assessment. By observing and interviewing users, designers can determine how a user currently accomplishes tasks and which tasks occur most frequently and are most important. The second method is usability testing. Typically, users are asked to carry out tasks on working prototypes, and the problems they encounter are observed and recorded so that the design may be improved before the product is deployed. The third method supporting UCD is customer feedback. This occurs after the product has been

deployed. It involves techniques such as monitoring which product features are being used and obtaining direct user feedback through interviews [7].

UCD is important because of the increasing number of people who are using technology. Professionals are not the only people using technical products, as was once the case. These products must now be designed with the average person in mind. Currently, many people are scared of using technology or frustrated with it because of experiences they have had with products which are much too difficult to use. This is a major issue that must be addressed in order to realize the full benefits of technology.

UCD is especially needed in the area of mobile applications. The driving force behind today's mobile applications is technology. The focus is on features and functions, not users [4]. There are many new technological capabilities emerging, but which will actually benefit the user? When voice was the only capability of mobile technology, there was little need to understand user needs, but with every new feature and capability that emerges, user understanding becomes more important. UCD will be essential in determining which new features are useful and how to best implement them [2].

2. PREPARATION

Throughout this case study, I referenced UCD information and processes from IBM [3], the Human Perspective Working Group of the Wireless World Research Forum [2], and two books, *User-Centered Design* [9], and *Leonardo's Laptop* [7]. I did not follow any of the processes exactly but used them as a guide.

3. INITIAL CONCERNS

As mentioned previously, I decided that a mobile grocery shopping application was to be developed. It would be developed using Java Platform, Micro Edition (Java ME) technology and intended for use on a personal digital assistant (PDA). Java ME was used since I was already familiar with the basics of the technology and a PDA was chosen because it seemed like a capable device and was easily available for my use. Soon after deciding on this product, I was notified and also discovered that other research involving grocery shopping applications for PDAs has taken place recently, particularly at Georgia Tech [6] and the IBM T.J. Watson Research Center in the UK [1]. The research at both institutions explores how grocery shopping can be aided by PDAs. Both address UCD to some extent but focus more on issues relating to the use of PDAs and the nature of grocery shopping.

I decided to target the grocery shopping application at college students, mainly because I had seven fellow REU (Research Experience for Undergraduates) students living within close proximity. These students kindly agreed to partake in this case study.

4. CARRYING OUT THE CASE STUDY

4.1 First Interviews

After recruiting participants, the first task was to interview them. The interview was designed to gain a better understanding of how the users shop for groceries, attitudes they have about grocery shopping, and the importance placed on different aspects involved in grocery shopping. The competition would be made known by identifying how they currently carried out their grocery shopping tasks. Some example questions were:

- How often do you buy groceries?
- Do you use a grocery list?
- Describe your grocery list.
- What are your reasons for not using a grocery list?
- Describe your grocery shopping process step-by-step.
- What is the most important part of grocery shopping?
- Are there any problems you have or changes you would make in the way you shop?

In summary, all of the users shopped only for themselves, anywhere from twice a week to once every two weeks. Some shopped mainly by brand, others by price, and some considered both. Some found the overall price they spent to be a very important factor while others simply glanced at the total price on the receipt after they had made their purchases. Some used a grocery list all the time, some only in new situations, and some relied mostly on memory. Those who used lists organized them by meals or by necessity of the food item. All users had a core group of food items they bought frequently, and all agreed that getting the items they needed or intended to buy was the most important part of grocery shopping.

4.2 Basic User Needs

From these interviews, three basic user needs were determined:

- Getting everything needed or intended to buy
- Shopping within budget or being mindful of prices
- Shopping in a time efficient manner

4.3 Second Interviews

I developed a second set of interview questions mainly to determine the priority of these needs but also to start identifying specific usability requirements and address basic design issues I had already begun to think about. Examples of these questions were:

- How important is the total purchase price to you?
- Do you think it would be useful to record prices or brand names from previous purchases?

- Would you rather organize a grocery list by meals or by individual items in order of importance?
- What is the maximum amount of time you would be willing to spend filling out a grocery list?
- How many items do you buy on a typical grocery run?

It was determined from these interviews as well as the previous ones that the order of importance of the three basic user needs I had identified was the same as the order in which they are previously listed in this paper. It was also determined that the way in which users currently attempted meeting these needs was through the use of grocery lists, human memory, or a combination of both. Thus, these were my product's competition. It also became evident that some of the main usability requirements would be having a product that was quick to use, straightforward, and simple enough to be used while moving about in a grocery store.

4.4 Early Design

With these issues in mind, I started designing the grocery shopping application. I decided to focus primarily on the first of the three basic user needs with the intent of developing a product that met this need and return to the other needs if time was available. My initial idea was to build upon the functionality of a grocery list. The product would have to be quick and simple enough to persuade users who did not use a grocery list to try it and useful and efficient enough to attract those who did use a list.

4.5 Paper Prototype

I considered somehow keeping track of past purchases or using a list of frequently purchased grocery items in order to quickly compile a grocery list with the necessary items. To better evaluate this idea, I created a very simple paper prototype. I used three plain sheets of paper to represent an old grocery list, a list of common items, and a new grocery list. I had the users write down grocery items on slips of paper and observed how they interacted with the sheets of paper in different situations. For example, I would have a user compile a list of commonly purchased grocery items and then ask, "If you were going grocery shopping today, given this list of common items, how would you go about creating a new grocery list?" The results I obtained from doing this allowed me to refine my design before I started writing the code.

4.6 Working Prototype

Next I developed a working prototype of the product and had the users test it out. Most had little or no experience with PDAs so I explained some of the basic functionality, such as how to use the keyboard or access the menu for an application. I then asked them to try and create a grocery list as if they were going shopping that day. I observed them as they did this and recorded any problems they had. Many of the problems were device related, such as not knowing to click an arrow next to a list item to select it. Other problems, however, were related to navigation issues and unclear features. For example, the original layout of the program required users to return to the main menu after viewing their grocery list in order to edit it, rather than simply clicking an edit button.

4.7 Wrapping Up

I made changes to the program to address many of the issues that became known as a result of testing the prototype, but other issues were not addressed because there was not enough time to develop a satisfactory solution. After addressing as many problems as possible and being content with the status of the product, I ceased development as the time allotted for the project came to an end.

5. FUTURE WORK

In the future, I would like to perform more rigorous testing on the product. It should be tested head-to-head against its competition and in an actual grocery store setting. Precise usability measurements should be taken, such as exact time to complete certain tasks and number of errors per task. I would also like to iterate the design process to address other user-defined needs and observe the ease or difficulty of adding this functionality on top of a working program.

6. CONCLUSIONS

Many aspects of UCD were not incorporated in this case study. There was no multi-disciplinary team designing the total customer experience, making the product easy to buy and set up. The product was not deployed, so there was no customer feedback about bugs or troublesome issues. There was no documentation in the form of data flow diagrams or use cases. Usability was not tested against a popular list of heuristics. Lastly, the development was not as iterative as many UCD proponents suggest.

However, despite all of these missing aspects, what remained of UCD still proved to be beneficial. "UCD is like exercise: You may never do as much as you should, but every little bit helps" [9]. I found the most helpful part was simply researching what UCD was, learning about its principles, and keeping these in mind while designing the product. Gaining a solid understanding of the users early in the process allowed useful designs to be made initially, rather than after much iteration. Keeping the competition in mind at all times ensured that the finished product would actually offer a viable alternative to users. Constant user feedback identified problems quickly so time was not wasted developing a faulty solution.

UCD was especially helpful since the grocery shopping application was developed for a PDA. Because of the limitations of the PDA, such as small display size, the application had to be very efficient. Only what was needed to meet the most important user needs could be included, and it had to be designed to be used by the limited capabilities of the device in a straightforward manner. UCD helped to identify the most important user needs through interviews, observations, and feedback, and it helped to make sure the device was usable through evaluation of prototypes.

In summary, UCD was used in this case study to develop a mobile grocery shopping application. With less than three weeks to

complete the project, time was a major design factor. Seven college students acted as participants in the case study and served as the users. At the end of the time period, a working application had been created, but more thorough testing was desired. Although many aspects of UCD were not incorporated due to time constraints, it was determined that UCD was a valuable design method for this application.

7. ACKNOWLEDGMENTS

This research was supported by the REU program at the University of South Carolina in Columbia. Thanks to Dr. John Bowles and Dr. Caroline Eastman for your guidance.

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