Shopping Cart Interactive Program (SCIP)

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Abstract. The Shopping Cart Interactive Program (SCIP) application was designed to improve shoppers' connection with the grocery retail environment. Nutrition is central to human life. Eating the right foods can significantly impact one's quality of life. With the capabilities of the SCIP application to provide an interface that can display readable health information on a mobile device and tailor to the specific dietary restrictions of its users, it will enable shoppers to have a less frustrating experience when shopping for food.

Keywords: Interface design, User-centered design.

1 Introduction

Our population is significantly aging. The first of the Baby Boomer generation (those born between 1946 and 1964) will turn 65 in 2011. It is estimated that 20% of the population will be 65 or older by 2030 [1].

Physiological changes associated with aging, such as decrements of sight, hearing, dexterity, motor functioning, hand-eye coordination and cognitive processing, make new screen technologies more difficult to use [2]. These changes occur regardless of gender, race or culture, and can have significant impact on quality of life. What used to be a simple trip to the grocery store may not be so simple for those experiencing these changes of aging.

The ability to read food and product information at the grocery store in a clear, concise and consistent format, is important to sustaining independence. Adults with dietary restrictions, such as the need for lower sodium intake, diabetes, and/or allergies, make it imperative to be able to read all nutritional information on packaging. This includes the nutritional facts, drug facts, supplement facts, as well as the complete list of ingredients. There is a lack of consistency in product packaging and not all information is visually presented in the same manner. This lack of consistency can create frustration among shoppers, in addition to the text sizes being too small for aging eyes to read, it can cause illness for someone with a dietary restriction that cannot properly read the product's contents.

The purpose of this project is to discover the proper design strategies for an application to be developed for a wireless device (i.e. Apple's iPad) to be used in a grocery retail environment. The device will function with Radio-Frequency Identification (RFID) tags placed on each product in the grocery store. The device will receive the product information and present it in a clear, concise and consistent

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format so shoppers will be able to read all of the nutrition facts and ingredients listed on a package.

During the second phase of this project, the following questions were answered with IRB approved usability testing:

1. Are adults age 46 and over receptive to using the Web-based application?
2. Will the application prove easy to navigate?

1.1 Demographic Analysis

According to Lee Rainie at Pew Internet & American Life Project, between the years 2000 and 2010, the number of older adults (aged 46 and over) using the Internet increased from 40% to 74%. Using the same comparisons, 63% have broadband at home, 81% own a cell phone, 46% connect to the Internet wirelessly and greater than 50% use cloud computing [3].

This group comprises those in the Baby Boomer generation (born 1946-1964), the Silent Generation (born 1930-1945), WWII children (born 1915-1930), and children of the Great Depression (born prior to 1915). While this group has enormity in numbers, it is not homogenous. Although similarities do exist, American society recognizes the life course theory through labeling blocks of years for any given population segment such as: young adult, adult, middle-aged adults, older adults, retired adults and very old adults [4]. While difficult, accepting these labels requires acknowledgment and realization of our advancing age in physical, psychological and social areas [5].

1.2 Design Concept

The older adult age group consists of varying socioeconomic levels and varying degrees of technological savvy. The concept was to develop an application for the grocery retail environment to address the issues of physiological changes that occur with aging when shopping at the grocery store. Accessing product information about food, supplements and drugs in a clear, concise and consistent format, was the main focus for developing the SCIP application.

Part of the concept is for the grocery store to provide a wireless device (i.e. Apple's iPad) mounted on a shopping cart with a closed, secure WiFi network. Differing socioeconomic groups of older adults would have access to the benefits of this device by the store providing it. A user could also use their own wireless device to login securely to the store's network. All shoppers of the grocery store of any age would be able to use the device, in addition to the older adult demographic that was researched for this project.

Each product in the store would be labeled with a RFID tag that the wireless device would read via a wireless antenna contained in the tag over the store's secure, closed WiFi network. RFID tags would complement barcodes and barcode readers, since they are more efficient, easier for devices to read and are capable of storing large amounts of information in their microchip. Nutritional information, pricing, expiration date, country of origin, size, weight, and further product information can be stored in the RFID tag related to a specific user's shopping needs.

Thomas Friedman, in his 2007 book *The World is Flat*, refers to RFID technology by stating, "This is clearly the wave of the future. RFID technology and sophisticated order analysis tools that monitor even the most minute market activity are rapidly leading us toward industry's holy grail—absolute balance in supply and demand," [6].

The mounting bracket on the cart would be adjustable to accommodate differing user heights and reduce glare, as well as allowing users with their own mobile devices to be able to mount them on the cart.

The team designed two different low-fidelity prototypes of user interfaces, User Interface 1 (UI1) and User Interface 2 (UI2), for the SCIP application. Both interfaces followed the same navigational flow and displayed the same types of information.

The following design guidelines were taken into account when the interfaces were designed [7]:

- Typeface: Use a sans serif typeface that is not condensed. Avoid the use of serif, novelty, and display typefaces.
- Type size: Use 12 point or 14 point type size for body text.
- Type weight: Use medium or bold face type.
- Capital and lowercase letters: Present body text in upper and lowercase letters. Use all capital letters and italics in headlines only. Reserve underlining for links.
- Physical spacing: Double space all body text.
- Justification: There are three ways to justify type; left, full, or centered justified. Left justified text is optimal for older adults.
- Color: Avoid yellow and blue and green in close proximity. These colors and juxtapositions are difficult for some older adults to discriminate. Ensure that text and graphics are understandable when viewed on a black and white monitor.
- Backgrounds: Use dark type or graphics against a light background, or white lettering on a black or dark-colored background. Avoid patterned backgrounds.

In regards to navigation through different screens, the team lessened the amount of vertical scrolling, kept the layout consistent, eliminated the need for a mouse by using a touch screen interface with a virtual keyboard, incorporated text with icons, used pull-down menus sparingly, and incorporated backward and forward navigation arrows on each page.

2 Evaluation Measures

Each of the five users were read the testing script prior to beginning the usability test. Each user test began with UI2, followed by UI1 with the same task list. After testing was completed, the team discovered that UI1 and UI2 should have been alternated as the beginning interface for each test. Instead, UI2 was used as the first interface for all tests. It is the author's hypothesis that the time spent per task on UI1 was less than it would have been if presented in an alternating fashion, due to the user's previous familiarity with the task list.

The user's mouse clicks and voice were recorded during each session and after both interface tests were completed, the user completed a questionnaire.

The first questionnaire was based on the user's demographic information. Questions included age, gender, native language, occupation, computer use, Web use, cell phone use, smart phone use, iPad use, online shopping, grocery shopping routine, problems reading product information on food product packaging and dietary restrictions. The questions were multiple choice.

The second and third questionnaires were identical, but one was related to UI1 and the other UI2. Questions were related to the interface's ease of use, accessiblity and usefulness. The questions were based on the Likert Scale and short answers.

2.1 User Testing

Survey participants were recruited using posters and word of mouth advertising methods. Software was used to record the screen to track mouse clicks and also record audio while the user thought aloud during testing. The recordings were tabulated to calculate where and how many mouse clicks were used during each user's testing session to determine errors.

The test administrator followed the testing procedure outlined below:

- Testing script was read verbatim and followed.
- Task list asking the participant to find nutrition facts for a product, find ingredients listed in a product, compare the amount of sodium in two products, add one product to shopping cart and checkout. This process was completed by the users using pre-filled form fields so that no private or financial information was collected.
- Survey questionnaire was completed by each user asking age, occupation, familiarity with technology, and post-test questions were given to determine participants' views on each of the two user interface designs application after completion of tasks.

2.2 Test Design

The team designed two different low-fidelity prototypes of user interfaces for the SCIP application. Both interfaces followed the same navigational flow and displayed the same types of information. However, the visual presentation of elements varied drastically. Prototype UI1 was based on using icons with text and prototype UI2 was a predominantly text-based navigation set within a modular grid format.

2.3 Testing Process

The two prototypes were tested during the same usability testing sessions with five users that were selected from a pool of respondents within the target demographic of adults age 46 and over. User demographics are displayed in Table 1.

Survey participants were recruited using posters and word of mouth advertising methods. The tests were conducted over a two-week period with the five users. The users were given a task list at the beginning of the session to use the Web-based application on a laptop computer where the screen was recorded to track mouse clicks, while simultaneously recording audio of the user thinking aloud.

Table 1. User demographics

User Demographic Facts Summary	
Question	%Breakdown
Age range	80% 46-55
Gender	60% female/40% male (5 users total)
Native language	60% English
Occupation	80% Professional
Computer use	100% Daily
Web use	100% Daily
Cell phone use	80% Daily
Use a smart phone	60%
Used iPad before	60%
Shop online	60%
Grocery shop routine	80% Weekly
Neither of the males in the study had dietary restrictions, but all three women had at least one. Two out of three women needed reduced sodium and reduced sugar intake. 60% of the users have problems reading the nutritional facts on food product packaging and 40% have problems reading the ingredients.	

It would have been ideal to have the application tested on a touch-screen mobile device, however, since the rapid prototyping method was used, the team created a low-fidelity application within a Web browser for use on a laptop computer.

3 Findings and Discussion

Both of the UI designs depend on the user already being registered in the SCIP program. The registration process can be completed at a store with the assistance of customer service or online via secure Web site. The user would fill out a submit form with their dietary restrictions so the SCIP application would be able to warn the user if any product in their shopping cart contains the ingredient(s) that is among their restrictions. For instance, if a user is allergic to peanuts, then the SCIP application would display a warning if that ingredient was present in the product when it was scanned.

The user would also be able to compare the nutritional facts with another product. For example, the sodium content per serving in two different kinds of canned soup could be compared to see which contains the lowest amount. This feature would be useful for someone keeping track of sodium intake.

In order to remove an item from the cart, the user simply places it back on the shelf as the device automatically removes it from the cart's contents. Once the user is ready to checkout, the checkout button is touched and the registered user's banking information or credit/debit card on file is charged for their purchases. This eliminates waiting in a checkout line to have the cashier scan each item and receive payment. The user can choose to bag their own groceries while shopping, or have a store employee bag their groceries upon checkout.

3.1 User Interface 1 (UI1)

UI1's design (Figure 1) was based on conventional Web site design. Contrast was kept between background and foreground to insure that older adults' reduced visual acuity was taken into account and the screen would remain readable. Type sizes were kept at 12 points minimum. Using the touch screen interface takes into account declining motor skills associated with aging, eliminating the need for a mouse or double-clicking. It also offers an alternative to the iPad's pinch-to-zoom option by keeping icons on the screen to adjust text sizes by touch.

Three options are presented at login.

1. Scan shopper card that is embedded with RFID tag
2. Use thumbprint
3. Use username and password

Fig. 1. Nutrition facts screen (left) and compare products screen (right) from UI1

According to User 3 the UI1 prototype was too time consuming and complex. User 3 mentioned confusion about the various login options. The user wasn't able to complete all tasks because the wrong menu path was selected which lead to a scramble of the task steps. The overall results of user testing were that 80% favored UI2 for both aesthetic design and functionality.

3.2 UI1 Errors

- Task 2.
  Scan a product.
  - 80% of the users did not immediately notice the scan product icon at the bottom of the screen. User 4 clicked 5 times on the wrong icons, as did user 3. User 2 and user 1 both clicked the wrong icon once before clicking on the correct one.

- Task 3.
  Find nutritional facts for a product.
  - 60% of the users had problems locating the nutritional facts. User 3 did not complete this task, even after assistance.
- Task 5.
  Compare the amount of sodium in a product with another product.
  - 60% of users had four or more errors while comparing products.
- Task 6.
  Add one of the products to your shopping cart.
  - User 1 said, "I am looking for add to cart button, by this time I would say screw this and get out of here. How do I get back?"
- Task 7.
  Scan another product.
  - 80% of the users had one or more errors while trying to scan another product.
  - User 1 said, "This one doesn't work, this one doesn't work, scan another item… far too small text."
  - User 3 said, "I can't read the text." Even after adjusting her bifocals the user required assistance to find the scan-item and check-out button in the shopping cart.
- Task 8.
  Find ingredients for a product.
  - 80% of users had one or more errors while attempting to locate the ingredients.
- Task 9.
  Read the first ingredient in the ingredient list.
  - 60% of the users did not find the icon for the ingredients at the bottom of the screen. User 2 clicked 6 times on other icons before reaching the ingredients page.
- Task 10.
  View the total amount of sodium for the contents in your shopping cart.
  - 60% of users had one or more errors while looking for the total amount of sodium in the shopping cart.

3.3 User Interface 2 (UI2)

UI2's design (Figure 2) was a novel interface concept based on the touch screen and inspired by the game Bingo. It utilizes large, square buttons in a modular grid structure.

Contrast was kept between background and foreground to insure that older adults' reduced visual acuity was taken into account and the screen would remain readable. Type sizes were kept at 12 points minimum, with very minimal use of icons. Using the touch screen interface takes into account declining motor skills associated with aging, eliminating the need for a mouse or double-clicking.

Two options are presented at login.

1. Sign in as a registered user

2. Use as a guest, without logging in

This UI offers the option for the user to either login, based on previously registering with SCIP program or by simply using the system as a guest.

Fig. 2. Login screen (left) and nutrition facts screen (right) from UI2

3.4 UI2 Errors

- Task 3.
  Find nutritional facts for a product.
  - Users did not recognize the nutritional facts by the percentages that were shown, or the layout in squares. An overwhelming 80% of the users had at least one error on this task. User 2 repeatedly clicked on the words, "nutritional facts" in hopes that a new window or new page would appear with the information. The nutritional facts were already displayed on this page after task 2, which was to scan another product was completed.
- Task 5.
  Compare the amount of sodium in a product with another product.
  - 100% of the users completed with this task with errors. User 2 was looking for an option to create a list to make the comparison work. The user wanted the page to do something more. After clicking on product search for the second time, the user needed assistance on how to get to the correct page to perform the task.
  - User 4 liked the color coding for the compare product screen. Nevertheless, the user was confused that the same color's (orange and grey) where used for other buttons like the compare product and nutritional facts button. Also the user was unclear about the chosen units for nutritional facts. User recommended to have no transparency for the "scan item" button on the side menu. The user noticed that the checkout buttons placement didn't correspond with the overall layout of the interface.

4 Conclusions

Since 80% of the users preferred UI2, the team will focus on redesigning that interface. The errors and preferences in the design of UI2 were consistent among the users. Tasks three and five proved to be the two tasks that were difficult for almost all users.

An interesting correlation became apparent in terms of color preference and gender. The color preference for UI2, was 60% (all of the female users) found the color palette of orange and grey pleasing. The male users (40% or all of the male users) strongly disagreed with the color choices.

The color palette of blue and grey used in UI1, created a mixture of pleasing vs. not pleasing. Only one female user one male user found the colors attractive.

The team will also add a strong emotional connection to the user. This would encourage user participation with the application and create a more pleasurable shopping experience. The team will use a more bold color palette to create contrast and evoke an emotional response from the user. They will also consider giving the SCIP application an identity based on an avatar.

In addition to adding an emotional connection, the team will add haptic feedback to the interface. Using sounds and vibration will help the user feel that the interface is responding to their actions.

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