Investigating Multi-Layered Interfaces: Two versus Three Layers of Division in Mobile Applications

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Abstract

Mobile applications for elderly people are often simple because of their lower mental capabilities with age. We investigate how Multi-Layered interfaces can help create a gradual learning curve for the elderly through our application, which displays their daily health reports. More specifically we will examine the difference between two-layered and three-layered interfaces through different versions of the same application we created.

I. Introduction

Mobile technologies possess the capabilities to help elderly individuals of diverse backgrounds lead comfortable lifestyles. Many mobile health applications exist that are designed to enhance the caregiver-elder relationship and the monitoring and maintenance of one's health. However, the benefits of such technologies are often not fully reaped; older adults tend to experience more difficulties in learning to use mobile phones and their accompanying applications [1]. Such difficulties include forgetting how to use new features and navigating through hierarchical menus.

In response to these issues, developers could create applications with only basic features. However, this would result in functionally lacking applications. Instead of crippling the product, a better solution exists: Multi-Layered interfaces. Multi-Layered interfaces refer to a stepwise manner of introducing a user to an application [2]. Rather than allowing a user to confront a complex, fully-functional version of an application, Multi-Layered interfaces refer to its separation into two or more layers of increasing complexity and functionality [2]. Thus, the user begins learning to use the fully functional application by first using a simplified version with relatively limited capabilities. After the user masters the skills necessary to operate the base layer, the user transitions into layers of increasing complexity and functionality [2].

A 2010 study performed by Rock Leung demonstrates the efficacy of this incremental approach in helping older adults (65-81) learn to use mobile applications [3]. Multi-Layered interfaces were found to promote both mastery and retention of the skills necessary to use a mobile address book application [3]. This study is more fully described in the following section.

II. Related Work

In September 2010, a study was carried out investigating the ability of Multi-Layered interfaces to ease the learning curve older adults face in mastering mobile technologies. This study was delineated in a paper titled "Multi-Layered Interfaces to Improve Older Adults' Initial Learnability" by Leung. In this study, Leung and his fellow researchers investigated the effects of a Multi-Layer interface in mitigating the learnability difficulties presented by a mobile address book application.

The study involved two groups: an experimental group and a control group. The experimental group learned a basic task set on a base, reduced-functionality layer before transitioning to a secondary, fully-functional layer and learning the advanced task set. The control group learned both basic and advanced task sets on the secondary layer. The participants, sixteen younger adults with ages ranging from 29 to 39 and sixteen older adults with ages ranging from 65 to 81,

were randomly assigned to one of the two aforementioned groups.

The study discovered that the use of Multi-Layered interfaces could indeed help individuals learn to use mobile technologies [3]. Leung found that Multi-Layered interfaces helped participants master basic tasks in fewer extra steps as well as retain that mastery [3]. Multi-Layered interfaces were also found to assist older adults more than younger adults [3]. However, it must be noted that the transition from the Multi-Layered base layer to the Multi-Layered secondary layer appeared to negatively impact participants' ability to perform basic tasks on the secondary layer (compared to control performance) in terms of significantly fewer extra steps and lower task completion times [3].

III. Problem Formulation and Methods

Leung showed that a Multi-Layered interface consisting of two layers can promote ease of learnability compared to the absence of a Multi-Layered interface [3]. Based on Leung's conclusion, we hope to further explore how to mitigate the learning curve elderly people face using Multi-Layered Interfaces. Our experiment extends his study by varying the number of layers with which the user is presented and focusing solely upon older adults.

We also use a different application in our studies. In lieu of the mobile address book application Leung and his researchers used, we designed our own mobile application. The application essentially presents the user with displays of health-related data. More specifically, the application display four charts/graphs displaying data such as the frequency of bathroom usage, time spent in bed, pulse rates, and motion hits.

The impetus behind the latter change is two-fold. Firstly, we wanted to use a more complex application for our experiment so the division of the application into three layers would be pragmatically justifiable. If the initial application is already too simple, its division into three layers would be unnecessary (two layers would suffice). Secondly, we wanted the complexity and function of the application in our experiment to more closely resemble existing the complexity and functions of existing applications designed for the elderly. This allows for the results of this study to be more applicable to the real world.

Two versions of this application will be created to compare the effects of a Multi-Layered interface consisting of two layers with the effects of a Multi-Layered interface consisting of three layers. One version will have the two-layered Multi-Layered interface and the other will have the three-layered Multi-Layered interface. The final layer of each version will contain the same functions as the fully-functional application.

In the two-layered Multi-Layered interface, the fully-functional application will be split into two layers. The first, base layer will contain the essential features, while the secondary layer will contain all the extra features. In three-layered Multi-Layered interface, the fully-functional application will similarly be divided into three layers. Again, each layer will contain increasingly less-essential features as one moves from the base to the tertiary layer. The features of the fully-functional application as well as the features contained in each layer will be more fully delineated in the Implementation section.

After the application is created, a study to examine the learnability of each version will occur at TigerPlace, an independent living space for the elderly in Columbia, Missouri. We intend to survey approximately twenty-four people in the home. Each participant will be randomly assigned to one of two groups. One group will be presented with the two-layered version of the application and the other group will be presented with the three-layered application. Each group will then be asked to perform a series of tasks using the Multi-Layered interface to which each group was assigned. We will measure the time a participant takes to complete a task as well as the number of extra steps each participant took. After the tasks are completed, the participants will be asked to fill out a survey, which will consist of several questions regarding their impressions of the Multi-Layered interface approach, the usability of the application, and possible improvement they feel could be made. Afterwards, we will analyze the data to determine which interface proves to be more salubrious.

IV. Implementation

As of July 2nd, we finished a basic version of our application. We have yet create the two versions of our applications. The finished portion of our application consists of a login page, a homepage and four graph pages. We plan to implement the layers in the next few days and the following extra features: switching to a different graph type, notification of data update, customizability of home page, simultaneous display of different chart types, zoom-in capabilities and min/max data point. Then we will publish it to all platforms as a hybrid application.

In our two-layer application version, we will have the base layer contain the graphs. Patients will be able

to view their data in easy-to-understand graphs. On the secondary layer, we will allow the users to be able to switch between graph types to view the same data, tooltip for coordinates, notification of data updates, customizability of home page, simultaneous display of different chart types, zoom-in capabilities and min/max search.

In our three layer application version, we will have the base layer have the graphs, tooltip of selected data points and notification of data updates. On the secondary layer, the users will be able to switch between graph types to view same data and simultaneously display different chart types for given data. For the tertiary layer, there will be customizability of the home page, zoom-in capabilities and min/max data point search.

After each version is completed, we plan to publish them as hybrid applications to work across all platforms. Hybrid applications allow us to create applications to be built in web development languages. When the user runs the application, the application is inside a native skin and uses the device's browser engine to render the HTML and locally process the Javascript.

At the moment, the application we have designed thus far draws from a database provided by the Center for Eldercare and Rehabilitation Technology at the University of Missouri in Columbia. The data presented was generated using real data gathered from Randall, a man who is over 70 years old. The graphs display information two months prior to a fall and two months after it based on data collected from motion sensors set up in his home. Although our demo displays information about Randall, it can be set up for users given that they have the sensors in their home.

VI. References

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