

COMBATting ALZHEIMER'S DISEASE  
WITH FAMILIAR FACES

By

TIM DIFATO

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Dedicated to my mother and father for their continued support, love and dedication. To my grandfather Big Mike, who sadly was plagued with Alzheimer's disease for the last several years of his inspiring life. Most importantly, this is dedicated to the one who paid it all for me, Jesus Christ. May my life, work and devotion be for your glory.

## ACKNOWLEDGMENTS

I thank my chair and board committee for their support. I also thank the countless people that have helped me understand iOS programming and applying my studies to the business field.

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## LIST OF ABBREVIATIONS

- AD ALZHEIMER'S DISEASE: A dementia disease that attacks a person's brain cells, reducing their ability to recall information and recognize familiar objects. This disease will be expounded upon in greater detail throughout the paper.
- SDS SUNDOWNERS SYNDROME: A mood disorder commonly associated with Alzheimer's disease. It is where a patient loses track of time, believing it is later in the evening than it truly is and vice-a-versa thus becoming agitated and confused.
- IOS The name of the operating system for Apple Company's mobile tablet/ phone product line such as, iPhone and iPad.

Abstract of Project in Lieu of Thesis Presented to the College  
of Fine Arts of the University of Florida in Partial Fulfillment  
of the Requirements for the Degree of Master of Arts

COMBATTING ALZHEIMER'S DISEASE  
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By

Tim Difato

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The purpose of this project in lieu of thesis is to create an iOS quiz application that helps impede the loss of memory from an Alzheimer patient and provide research data to aid in finding a cure. In addition, this project allows family members or friends of a person with Alzheimer's disease to actively participate in finding a cure by generating the specific content that their friend or family member would see once they run their application. In no way am I stating that this application will directly cure or restore a brain with any stage of Alzheimer's disease. Currently there is no cure for Alzheimer's and it is the 6<sup>th</sup> ranked cause of death in the United States. There are few partial solutions on the market today to help individuals with AD as it is a disease that literally shrinks the brain over the life cycle of the disease. With that said, this application will keep the patient's brain active and stimulated on a daily basis by asking questions that are unique to the individual participant. The questions are created by family members through an online website that ports the content directly to the iPad. This product is different from other potential solutions in that the application is specifically tailored to the individual user rather than one single universal application for all users. While it may seem like a simple quiz application to the Alzheimer patient, it is actually logging data

about the patient for doctors to observe. Such data consists of quiz/question success rate, question specific demographic data, time taken to complete each quiz/question and several others that will be discussed in this paper. The research goal of this application is to take the data and parse it into valid strings of information for analysis to find patterns in the life cycle of the Alzheimer's disease as well as stage progression for a large group of users. The purpose of this application is to build research information on this disease while also aiding the patient and caregiver inside the home.

## CHAPTER 1 INTRODUCTION

### **Personal Motivation**

In 2007 my 87-year old grandfather was diagnosed with mild Alzheimer's disease (AD). By viewing the short-term signs and symptoms, doctors were able to approximate the stage of Alzheimer's my grandfather was currently in, but were unable to verify with certainty the severity of the disease and the speed at which it would progress. Within a few years, my grandfather's disease matured rapidly, to the point where he could only remember 4 out of his 26 grandchildren. He was easily agitated and became unaware of his surroundings, time and space. His mind became less active and he clung to his wife, which drained her physically and emotionally. Ultimately, Alzheimer's disease led to the deterioration of his mind and the passing of his life.

Sadly, stories and experiences similar to my grandfather's are heard far too often by millions of Americans. Families battling Alzheimer's disease are caught in a multifaceted war, juggling financial burdens with treatment options, keeping their loved one's mind active and stimulated, while also dealing with the emotional stress of a family member with this disease. If that weren't enough, families come to the realization that doctors do not have a cure for this disease and need more patient data to find a solution. As noted in my abstract, this project's goal is to help the daily caregiver, the family member and the doctor by presenting the patient with a daily task to complete on the iPad. This task would connect the patient with family members from around the globe while also recording and sending viable data back to doctors and researchers to help find a long term, permanent solution to Alzheimer's disease.

## Medical Introduction to the Alzheimer's Disease

Alzheimer's disease is classified as a form of dementia, which targets the brain and slowly eats away at a person's memory. Dementia is defined as any disease that results in the loss of brain function, which affects memory, decision-making, language and thinking. On a biological level, nerve cells in the brain, known as neurons, are being damaged or destroyed which inherently leads to the distortion of human functionality and emotional discernment allowing fear of abandonment and depression to become common side effects of dementia.

Doctors have broken down Alzheimer's disease into seven stages. Each stage reveals harsher symptoms than the previous due to increased brain cell damage and deterioration. The brain is gradually infiltrated by what doctors describe as "tangles" <sup>[1]</sup> which are twisted strands of a protein that are a cause for tissue loss and cell destruction <sup>[Figure 1.1]</sup>. Figure 1.2 shows the process of these tangles and how they affect different areas of the brain as the disease progresses from stage to stage. <sup>[Figure 1.2]</sup> Figure 1.3 and figure 1.4 compare the average size of a healthy brain and a brain that has been damaged due to advanced Alzheimer's disease. <sup>[Figure 1.3]</sup> <sup>[Figure 1.4]</sup> Dementias do not result in the loss of memory simply because an area of the brain is not working properly. In actuality, people lose their memory and decision making ability because certain areas of the brain are physically being destroyed and deteriorating. <sup>[2]</sup>

The most common form of dementia is Alzheimer's, which accounts for 60%-80% of all cases. <sup>[3]</sup> In addition to being the most-commonly seen form of dementia, it is also one of the most unknown. The 2012 "Alzheimer's Disease Facts and Figures Report" from the Alzheimer's Association writes, "Although research has revealed a great deal

about AD, the precise physiological changes that trigger the development of AD largely remain unknown. “ [4]

### **Project Background**

In America, every 68 seconds a person develops Alzheimer’s disease. [5]

An estimated 5.4 million Americans are living with Alzheimer’s disease. That number is estimated to increase by 10 million more people with the aging of the baby boomer generation. AD is a serious issue in the world today, but the problem truly unfolds when you look at it on a case-by-case level. Daily struggles for patients vary depending on the stage of AD. Advanced Alzheimer’s can lead to issues such as thrown off sleep cycles, aimlessly walking the neighborhood, losing ones sense of direction, and forgetting familiar faces. As noted in earlier sections, my grandfather only remembered 4 of his 26 grandchildren. The 4 that he remembered were the ones that visited weekly, which meant if you lived far away, you were forgotten. Because of this, certain family members felt hopeless in partnering with the recovery and wellbeing of their loved one.

With that in mind, as AD progresses, patients start to feel abandoned because they cannot remember their communities and families around them. Consequently, the fear of losing the ones they are closest to creeps in, so naturally they respond by clinging to their spouse or daily caregiver. I received a first hand experience with my grandfather who clung to my grandmother, which physically and emotionally wore her out. Several times I would sit down with him to give my grandmother and the paid caregiver a break. He slowly would open up to me and responded well to familiar objects, stories and faces. His overall attitude and demeanor went from anxious and frustrated to relaxed and friendly.

Several caregiver techniques that are used by medical professionals support the methods that I described above and have statistically shown positive results through medical testing and studies. One research study took 37 Alzheimer's patients and applied a cognitive intervention technique that consisted of, "training in face-name associations, spaced retrieval, and cognitive stimulation." [15] The study writes that, "During the intervention, AD patients showed significant improvement in recall of personal information, face-name recall, and performance on the Verbal Series Attention Test." [16] Though this survey did not prove to provide long-term relief to the average signs and symptoms of the patient, it did display positive short-term results to memory recall and overall quality of life for the patient. Another study, which used board games to help increase patient care and family involvement in the patient's medical treatment, provided a three-fold increase in patient engagement. In addition, patient caregivers and staff members were educated on the patient's family history and background due to the increased involvement of the family. [17]

When looking at my grandfather's specific case and the caregiver research available, I realized that he didn't simply need a medical drug to help him; he needed someone or something familiar to keep his mind active and occupied. He needed a tool that would help increase his quality of life, mental state and the family involvement in his life. This is why I created a medical iOS application for Alzheimer patients called "Family Connect for Alzheimer's".

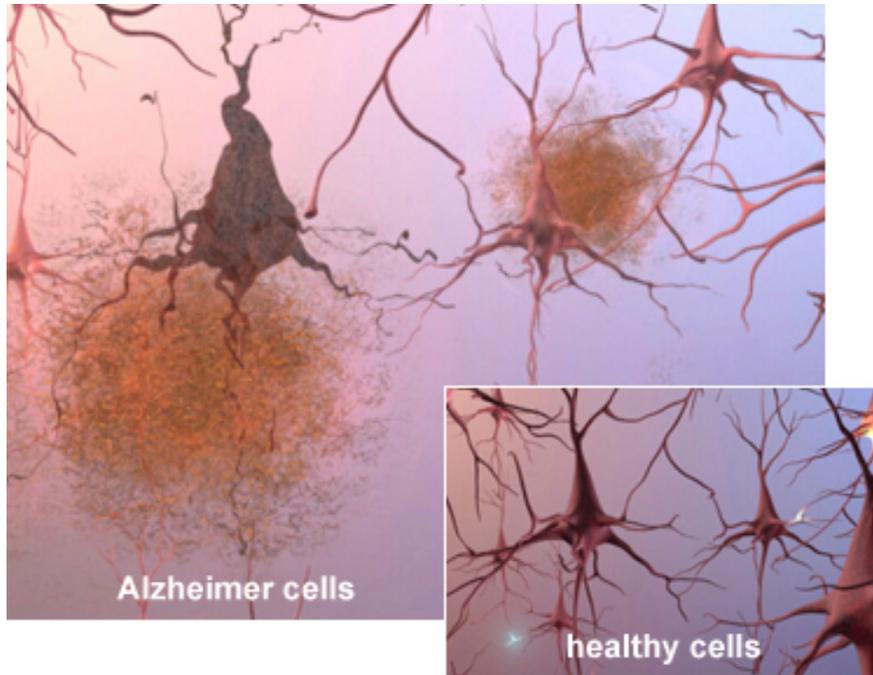


Figure 1-1. Digital representation of dead cells being clouded by plaques, which are abnormal groups of protein in comparison to healthy cells. <sup>[18]</sup>

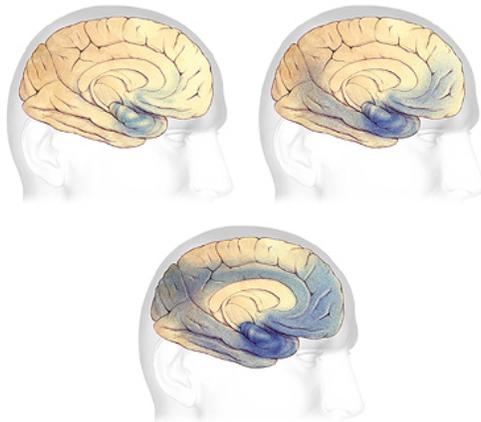


Figure 1-2. Digital representation of multiple stages of AD. Top left displays earliest form of AD. Top right displays mild to moderate Alzheimer's stage. Bottom center displays severe Alzheimer's stage. <sup>[18]</sup>

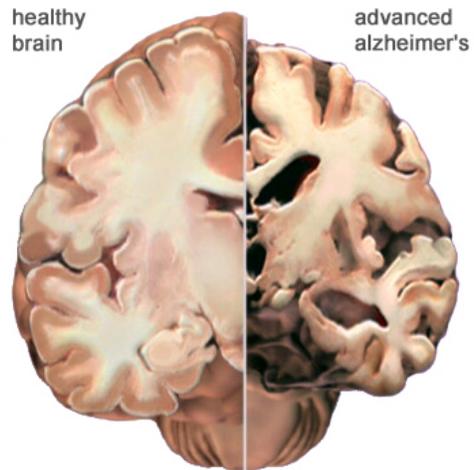


Figure 1-3. Digital comparison between a healthy brain and a brain with advanced AD.<sup>[18]</sup>

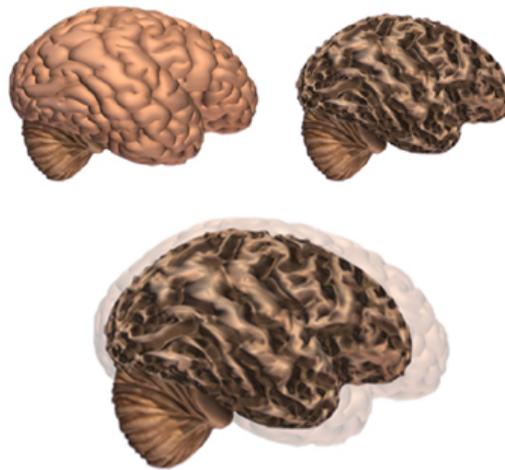


Figure 1-4. Digital comparison between a healthy brain and a brain with advanced AD.<sup>[18]</sup>

## CHAPTER 2 PROJECT OVERVIEW

### **Project Implementation**

As described in my abstract, the application is a basic digital quiz that the applicant would use daily. Family Connect for Alzheimer's (Family Connect) asks the participant questions that are specifically generated by the family members online. A sample question would be, "Hi mom! Its me your Son Jack. Tap on the picture of me. I love you." Below this question would be four pictures of people, three of which would be incorrect while the last one is the correct image of Jack. <sup>[Figure 2-1]</sup> The participant taking the quiz would simply tap the picture that is correct. Following the question, another will appear and the process is repeated until completed. This application was built for four reasons; patient comfort, basic caregiver tool, family participation and medical data research.

### **Patient Comfort**

Early onset AD occurs around the ages of 60-65. Patients in this stage are consciously aware that they are losing their memory. It usually begins by forgetting basic daily items such as where your keys are located or if you've checked the mail today. It is not uncommon for early AD patients to ask themselves if they have completed a certain task already, knowing that they very well could have done this task several times today. This can leave an overwhelming sense of hopelessness inside of a person, knowing they should know a certain topic but simply cannot recall it. Family Connect for Alzheimer's allows people with earlier signs of AD to feel like they are

preemptively attacking their disease and working out their memory. Though this application primarily targets patients who show more serious signs of advanced Alzheimer's, Family Connect has the ability to be set to a more difficult setting for people who are overly successful at the game and find it too easy. [\[Figure 2-2\]](#) If nothing more, this application allows people with early onset Alzheimer's to feel like they are actively combatting the affects of this disease by strengthening their mind with familiar images.

As I alluded to earlier, patients with advanced AD cling to the ones they are familiar with due to the fear of being alone or not knowing how to solve a problem. At this stage, they are mostly unable to consciously reflect and acknowledge the disease that is present in their body. Family Connect is primarily built for patients in this stage of AD. The application tries to connect familiar faces with active questions to help patients find a sense of belonging rather than abandonment. In 2012, 1 in 7 Alzheimer's patients lived alone and half of them had no main caregiver. These people are more susceptible to injury due to malnutrition, wandering, falls and self-hygiene. This application would become a perfect outlet for these people to be able to connect to familiar faces in their community.

An online Alzheimer's awareness forum, which allows caregivers and family members an outlet to expand on their findings and experiences, shows the majority of family caregivers encounter these abandonment issues with their patient. [\[6\]](#) One author of a forum wrote about his mother Dotty saying, "When I left Dotty alone she quickly

became scared, confused, anxious, and I soon learned she feared that I was going to abandon her. Or worse, put her in a home to rot.”

Family Connect allows patients to interact with family members indirectly. Keep in mind, this is not a live chat service or two-way communication device between patient and family member. One of the goals of this application is to help the patient feel a sense of community by reminding them of the friends and family members who care about them. A major feature to be implemented into the next phase would be the ability to play a recorded audio sample of the question being read a loud by a familiar voice. This way the patient would be even more submersed in the experience and hopefully reduce the barrier between the patient indirectly interacting with family members by making them believe they are communicating with that person in real time.

### **Caregiver Tool**

Family Connect for Alzheimer’s is not only an application for the benefit of the patient, but also the caregiver. A caregiver can be described as a paid or non-paid attendant who oversees the daily wellbeing of the patient. In most cases, the spouse of the patient is the direct caregiver. In cases like my grandmother, a paid caregiver oversaw my grandfather during the day and my grandmother watched him at night.

As mentioned above, AD patients latch onto familiar faces and usually keep them in line of sight. If a person leaves the patient too long, the patient will aimlessly wander in search of that person. In addition, once sundowners syndrome starts to have an effect on patients, they begin to believe the day is later than it truly is. <sup>[14]</sup> Because of this, advanced AD patients prepare for bed earlier than normal and expect their significant other to join them for sleep. This is a very common scenario where the

patient then becomes irritated because they don't understand why their loved one does not want to join them. All of these small daily events can add up to become a major emotional and physical burden for the caregiver.

If the caregiver is a spouse or family member, the benefit is that they get a daily break from the duties of caring for their loved one with Alzheimer's. The app should be used daily, at the same time to create a schedule for the patient. This has several advantages. Firstly, this reduces the variables introduced when evaluating the results. For example, by having the patient take the quiz daily at 4pm, researchers can highlight mood changes, patterns and habits accurately because the quiz was taken with consistent environmental settings.

The second reason for establishing a routine is because routines are one of the first things that are lost once the disease starts to infect the brain.<sup>[7]</sup> One of the best techniques used to help AD patients is to establish a daily routine so that they can expect certain things at a certain time. This gives them a reason to actively stay aware of the day and time.

## **Family Participation**

As mentioned in my abstract, one of the goals for Family Connect is to allow family members the ability to actively help in the treatment and care of their loved one with AD. Regardless of location and proximity to their loved one, family members can populate the content of the application for the betterment of the patient. This application requires the social involvement of outside parties away from the immediate caregiver. Without the participation of family members generating questions for the application, Family Connect will be an ineffective tool to retrieve data and entertain the patient. In

most scenarios, extended family members want to be involved but cannot find a way. This allows them the ability to not only populate the quiz with questions, but also to see the results of those questions and monitor the progress of the participant.

Once a quiz has been completed, the application automatically sends a compiled database to the server to be backed up and displayed on the website. Currently the website does not parse the database file and display the data online but this is an attainable goal for any future versions of the application. With this structure in place, the family would have the ability to upload questions and see the results of their work. This allows the family to feel included and informed on the status of their loved one.

### **Doctors and Researchers**

Just as family members can view the results of the quiz, doctors and researchers will also have that ability online. With this information, doctors can match data results and trends with previously studied material to help find new areas of Alzheimer's behavior. For instance, AD patients in mid-to late stages quickly acquire what doctors' call Sundowners syndrome. <sup>[14]</sup> Patients believe the time of day is later than it actually is and get anxious. Their whole internal clock begins to become thrown off and as a result they wake up earlier than usual. Add this effect to their distorted memory and you find people with advanced Alzheimer's disease quickly become lost and aimlessly wander. With this in mind, if a patient uses this application every day at 4pm, doctors can take the data recorded by the quiz to help discover the severity of the patient's side effects.

The application allows the administrator, doctor, or researcher the ability to track past results in order to find commonalities in the participant's answers. Family Connect records the demographic data of each question's image in the quiz. The administrator

can now search by predicates to find which images the user was successful in answering and which they struggled with. A possible example could be, grandpa remembers all women but struggles remembering men, more specifically men with black hair. Another example could be, grandpa remembers events before 1975 but not after. If this free application were in use by 2,000 participants, doctors and researchers would now have a large, at home focus group from which to pull daily data from.

This application was built to bring value to several areas rather than simply the app user. Family Connect for Alzheimer's is looking to bring comfort to the patient, relief to the caregiver, awareness to the family members and data to the doctors to help find solutions to Alzheimer's disease.

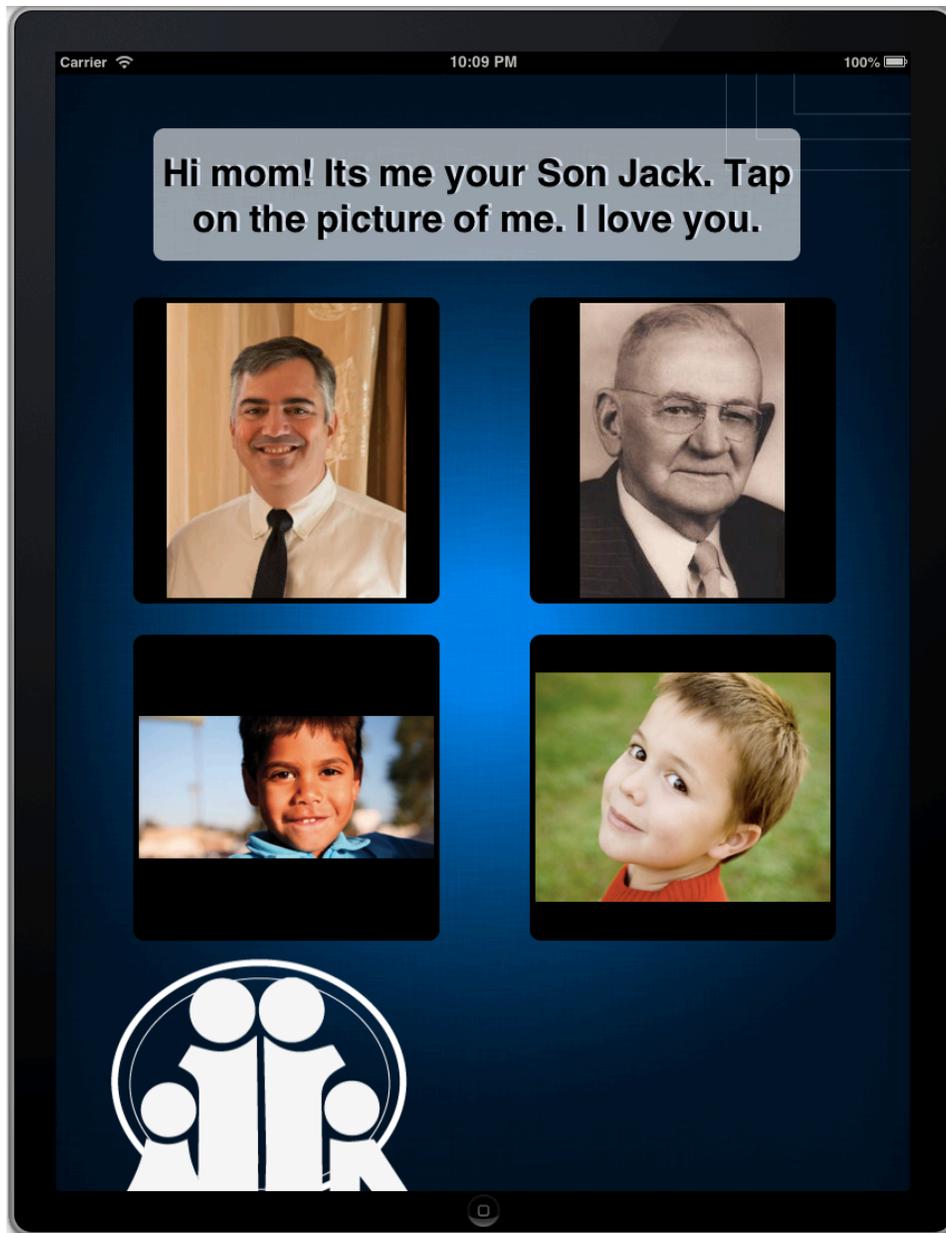


Figure 2-1. Example of a question inside of Family Connect. The correct picture (top left) surrounded by three incorrect images. The question was loaded from the Internet. By tapping the image you move onto the next question.

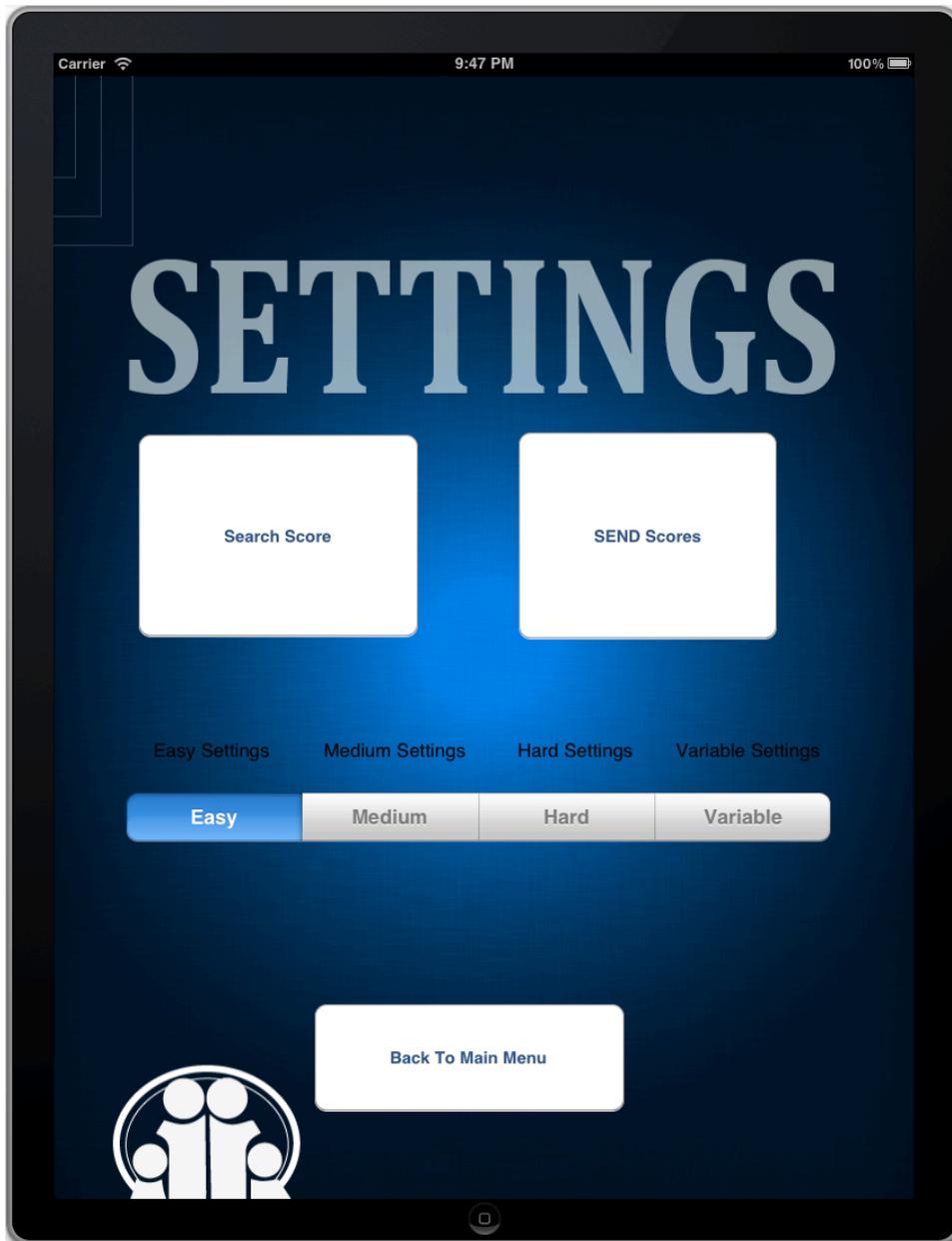


Figure 2-2. Example of the settings menu. Here you can set the question difficulty which affects the incorrect images that are displayed in the quiz. The harder the setting, the closer the incorrect images are to the correct one. It also allows the caregiver to search previous quizzes taken and view the scores, as well as manually send the scores to the Internet.

## CHAPTER 3 TECHNOLOGY

### Why iPad?

In 2010, Apple Corporation released their first tablet device called the iPad and today over 84 million have been sold. The iPad runs a proprietary operating system called iOS. This operating system was specifically built for Apple's line of mobile devices such as the iPhone, iPad and iPod. The device was built with a 7.75x5.82 liquid crystal glass touch screen (diagonally 9.7 inches) and one main "Home" button which is a physical button located directly below the screen. The iPad has a sleek design and simple interface. The user interface (UI) is an assembly of square icons called "apps" which are located in rows and columns once the iPad is turned on. [\[Figure 3-1\]](#) The iPad, has the ability to orientate its view to landscape mode to give the user more screen real estate to work with. The iPad comes with built in Bluetooth capabilities to communicate with other Bluetooth devices as well as built in Wi-Fi capabilities. Finally, the iPad has a built in lithium-ion polymer battery which can last up to 1 month on stand-by.

The iPad has one of the most intuitive user interfaces by allowing users to simply tap the screen to register an action. Because of its flexibility as a portable device and its "plug and play" interface design, the iPad is the perfect medium to host an application that is targeted to senior citizens. After user testing the application with several elderly participants, [\[See Section 4 User-testing\]](#) I found their average time to select an answer in the quiz (correct or incorrect) was around 3 seconds. [\[Figure 3-2\]](#) This indicates that people easily adapted to the controls of the device and quickly learned how to register an answer in the quiz. By placing the words, "tap", "press" or "push" in the question text, all of the participant's first attempts in answering a question were by taking their finger and

tangibly pressing on the screen image. The learning curve for the iPad device is rather low for elderly users due to the larger screen size, which allows the buttons in the quiz to be 275x275 pixels. Because there is no need for a mouse or third party device to run the iPad, the room for confusion and error in my testing was almost non-existent. <sup>[8]</sup>

### **Application Language and Workflow**

iOS applications are all written in objective-C which is an object-oriented language. Objective-C is a small extensive to the ANSI C language. To develop an iOS application, a person must download the developer kit and receive a license. This license costs \$99 and allows users to download the developing software called Xcode as well as port their applications to a testing iOS device. Without this license, your application cannot be submitted to Apple for review and entry, which allows your app to be sold on the Apple Application Store. The Application Store (App Store) is the only way to distribute apple created iOS software.

Included with the developing software are Apple's custom made classes, which Xcode recognizes as adequate Objective-C objects to run their application. Some of these custom objects include "applicationDidBecomeActive" which I use when the application is turned back on after being asleep or exited. This class allows Family Connect to rescan the server/XML file for any updated questions. With prebuilt classes, Xcode and Apple make programming a little easier to create a well-designed application.

The layout of my application is based around three components; a view, a controller and a model. <sup>[Figure 3-4]</sup> The model contains the data for the application, such as the quiz information or images. The view then is called which displays the data from the

model. Finally, the controller is the agent that goes and accesses the information from the model and sends it to the view to be displayed.

Specifically, my application starts by calling an application delegate which is the initializer for the application to load. Here, the app delegate searches the server for an XML file of questions generated by the website, as well as searches the application for a pre-existing SQLite database of quiz results. If this is the first time the application is in use, it creates a fresh database with zero entries, else it appends the existing database with the new question answers.

Once the application receives the data from the Internet, it sends it to a parsing agent which chops up the XML document into manageable pieces of data. Several of the attributes that become separate by the parser are, “Question text”, “Image URL”, “Image Gender”, “Question Number”, etc. From here, the individual parts of the question are sent to a question store which momentarily hold the data until it is later called.

From here, the controller pushes the view to a “Splash View” which contains the main menu. [\[Figure 3-5\]](#) [\[Figure 3-6\]](#) This menu simply acts as a train station, allowing the user to either enter the quiz or go into the settings menu. The main functionality of the application occurs in the Main Quiz View Controller, which communicates and interacts with nearly every area of the application. [\[Figure 3-7\]](#) Within this UIView, the application calls the question store and asks for each individual question at a time. [\[Figure 3-8\]](#) That data is then displayed on the screen and allows the user to select them by assigning the correct pictures to a randomly selected button. [\[Figure 3-9\]](#) At the same time, the “Quiz Controller” calls another store filled with incorrect question images. This store populates

the three remaining buttons in the quiz by sending them to the view to be displayed. The first quiz question has now been created.

Once the first question has been loaded, a hidden timer starts to take a count of how long the person takes on each question. In addition, the quiz view references the settings view controller and finds out the difficulty settings that the administrator has selected. The difficulty selected tells the quiz which incorrect pictures to populate next to the correct one by searching the image predicates. [\[Figure 3-10\]](#) An image predicate allows the computer to sort images by race, gender, hair color or age. The more difficult the setting, the more closely the incorrect images will resemble the correct one.

Once the question is populated and answered, several variables are stored into the application's database. The database is different from the application stores in that the database is contained in a single SQLite file and stay with the application forever, unless deleted. The store information is not as permanent as the database entries. The database is built around Xcode's Core Data foundation. Core Data is an easy to use solution for creating entities in a database. In figure 3-10, you can see how Family Connect organizes its database with entities and attributes. [\[Figure 3-11\]](#) Each quiz taken becomes an entity. Each entity has attributes such as, "incorrect Score", "quiz ID" or "overall Difficulty". The database allows the user to easily call any entity such as "quiz ID" and will then display that entity's attributes in a nice scrolling table.

Once the quiz is completed, Core Data logs the answers into the database and the view controller takes the user back to the splash view (the main menu). Afterward, the results can be viewed in the settings menu and broken down by sorting the attributes through predicates. Again, a predicate simply tells the searching function to

find objects that meet certain criteria, such as “Scored Correctly” or “Gender”. In addition, after every quiz is taken, the application uses a free Xcode extension called ASIFormDataRequest, which allows the SQLite database file to be sent to a server for backup. From here the server can take that database and populate an online view that breaks down the results so that family members and doctors can stay informed.

The application is fairly simple in that it is constantly receiving and sharing data with a server by using a model, a view and a controller. This allows each application user to have a unique experience, by viewing meaningful content specific to them.

### **Server Language and Workflow**

The application is constantly interacting with the server running a PHP script. PHP is defined as “a server-side scripting language designed for web development.”<sup>[9]</sup> PHP is one of the most popular forms of web development and is installed on more than 20 million websites. PHP allows for websites that were once static to now become dynamic and receive data from online participants. The application’s website is hosted by host-ed.me which allows PHP scripts to be run unlike plaza.ufl.edu.

At [timdifato.host-ed.me/thesis/index.php](http://timdifato.host-ed.me/thesis/index.php), a person can go and find out information about the iPad application. Here the family member would upload a picture and tag all of the metadata that describes the picture, such as gender and age. <sup>[Figure 3-12]</sup> The PHP script then takes that information and generates an XML document, which lists all of the questions and image information. <sup>[Figure 3-13]</sup> If any errors occur during the upload, the PHP will notify the user by posting an error message to the website. <sup>[Figure 3-14]</sup>

Once the picture is uploaded, it is neatly organized on the server under a folder labeled “pictures”. Once the iPad application is turned on, the app delegate will search the server pictures folder to grab the images. This is the entire workflow of the application and server. A PHP script allows users to upload pictures to the server and makes an XML document which the iPad parses to receive all of the data. Finally, the iPad sends back a database file of all the participants’ results, which get saved to the server. [\[Figure 3-15\]](#)

### **User-Interface Design**

A major element to the success of any application is its user interface design. The mechanics of an application can be perfect, but if the design does not compliment the mechanics by allowing a simple workflow and ease of use, then all of the programming is useless. This task is especially important for elderly people due to the higher probability of visual impairment and disabilities compared to the younger iPad users. Special attention must be given to the application’s color scheme, button layout, fonts and object size. Due to impaired vision, elderly people need interactive buttons to be two times the size of regular buttons, as well as contrasting colors. Dick Stroud, expert designer from OMD Marketing suggests that all design layouts for elderly people should have darker backgrounds, preferably tones from the bottom half of the hue circle, compared to the lighter interactive foreground elements. These darker backgrounds are best complimented with light foreground elements such as white silhouettes and outlined text. In addition, when creating text it is best to have “spacing between lines be at least 25-30% of the text size. The larger the font the smaller the text leading needs to be. [\[10\]](#)

With this in mind, I created several Family Connect designs and tested them on several participants at different ages to find out how functional the design aesthetics were. Figure 3-15 shows the three sample designs, which range from lighter to darker background tones and slightly differing fonts. [\[Figure 3-16\]](#) ([Sample 1 Dark Blue](#), [Sample 2 Lite Blue](#), [Sample Three Lite Green](#)) The most popular design for people 55 and under was sample 3, “Lite Green” [\[Figure 3-16c\]](#) but people 55 and over found sample 1, “Dark Blue” [\[Figure 3-16a\]](#) to be a better fit. The younger participants were more interested in the pastel color scheme and hidden aesthetic elements while people over 65 were more interested in utility and ease of use. Elderly people enjoyed the dark blue background of sample 1 compared to sample 3 because the green background did not give enough of a contrast between the foreground texts. Several noted that the color of the text in the opening screen for sample 3 was a bit confusing. [\[Figure 3-17\]](#) The opening screen is shown while the application loads the data from the Internet.

The main menu was designed to be as simple as possible, seeing as elderly people with Alzheimer’s disease are the ones who will use and initiate the quiz. The design idea was taken from the first dropbox.com home page, which had one button that said, start dropbox. [\[Figure 3-18\]](#) It was clean and user friendly. In the bottom corner of Family Connect’s main menu, there are 2 common iOS icons to allow a person to navigate to the settings menu or refresh the page. Rather than giving these elements large buttons and recognizable text, I wanted them to be hidden. The reason these items are blended into the background is so that the patient using the application does not use them. These are simply for the caregiver to monitor progress.

All of the background elements and buttons were created in Adobe Illustrator because of Illustrator's ability to create vector art, which can be stretched without losing quality. This way, I was able to resize the objects I needed without making images or buttons pixelated. The user testing is still in progress, but I believe I am on the right track with highly contrasting background and foreground elements with bold large text for users to see.

### **Future Improvements**

Currently, the application is in working condition with multiple people actively testing the app, but this is simply my first iteration. There is always room for improvement. The first improvement would be the optimization of the parsing engine. Currently, the application grabs the entire XML document and parses all of the questions and images ever given and puts them into memory. This can result in a long application load time and can detract from the user experience. A future solution would be to dynamically parse five questions at a time and as the quiz advances, the application parses the next questions in line.

Possible future aesthetic improvements might be a progress bar to show how long the application needs to load. In a previous version of Family Connect, after the quiz was completed there was not any indication that the person finished the quiz; it simply went back to the main menu. After early user testing, a participant wanted some kind of reward for taking the quiz, which is why I implemented an encouragement page after completion of the quiz. User feedback is an on going process and is vital to any product design.

Another possible addition would be to add a sound element to the quiz by letting family members record their voices when submitting a question online for the iOS user to hear when taking the quiz. Several user-testing participants noted that the use of stories and familiar sounds showed great results in their loved ones memory recall. By allowing family members to shape a question by telling a familiar story to help remind the patient of the speaker's image, would greatly improve the experience.

During user testing, [\[See Section 4 User-testing\]](#) one woman believed that a person's personality type before being diagnosed with AD would affect how they handled their disease. How does a person who lived with an extroverted personality type handle having to lean on others and trust in their decision-making compared to a person who lived a more passive lifestyle before AD? Does this have an affect on how the person behaves or how the disease matures psychologically or is there no correlation? This would be a great question to pursue as it could lead to vital information how to treat people with different personality types, rather than having a generic caregiver solution. She suggested having a section in the quiz for a spouse to quantify the patient's prior personality type. For example, on a scale of 1-10, how independent was your loved one prior to Alzheimer's. I believe this is a tremendous feature to add, which would allow the doctors and researchers the ability to look into new areas of Alzheimer's treatment.

An obvious future step of development would be to graphically display the test results of a participant online. In addition, each family would have individual account, which would privately store their information and pictures. With that said, I would have

to build a login solution for the application. As of right now, the application is built for one user.

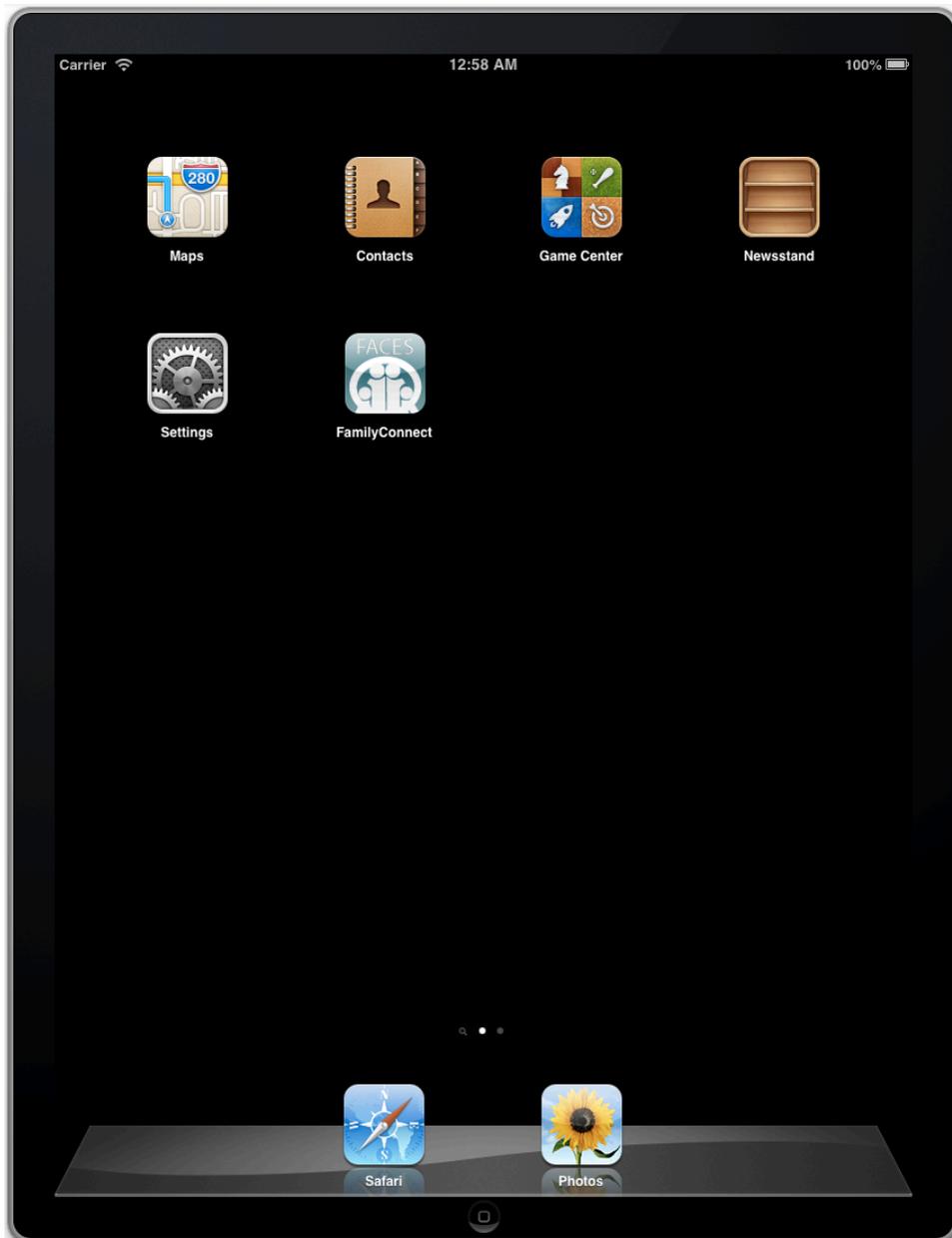


Figure 3-1. An image of the iPad user interface. Each application shown by a 72x72 pixel icon.

GROUP TWO TIME PER QUESTION			
Question #	Participant #1	Participant #2	Participant #3
1	00:05.3	00:04.1	00:04.1
2	00:03.8	00:04.7	00:03.1
3	00:04.1	00:03.1	00:03.8
4	00:02.1	00:03.2	00:02.2
5	00:04.1	00:03.8	00:03.8
6	00:03.1	00:02.9	00:04.1
7	00:02.9	00:02.7	00:02.2
8	00:03.2	00:05.1	00:04.1
9	00:04.5	00:06.1	00:03.0
10	00:05.1	00:04.2	00:02.2
11	00:02.2	00:05.1	00:02.7
AVG TIME	00:03.7	00:04.1	00:03.2
AVG TOTAL TIME	00:03.7		

Figure 3-2. Results of user testing from a group of 3 participants. This shows the time it took them to complete each question as well as the average question time of 3.7 seconds.

Question Number	2
Score	0
Wrong	1
Difficulty Level	Easy
Gender	Female
Age	Young
Race	White
Hair	Black
Time it took to complete Question	00:00:03.806
Question Date	2013-03-29 05:07:22

Figure 3-3. Shows the breakdown of the individual question results. This information can be found inside the Family Connect's settings page. Here you can see where the individual question timer records the data for Figure 3-2.

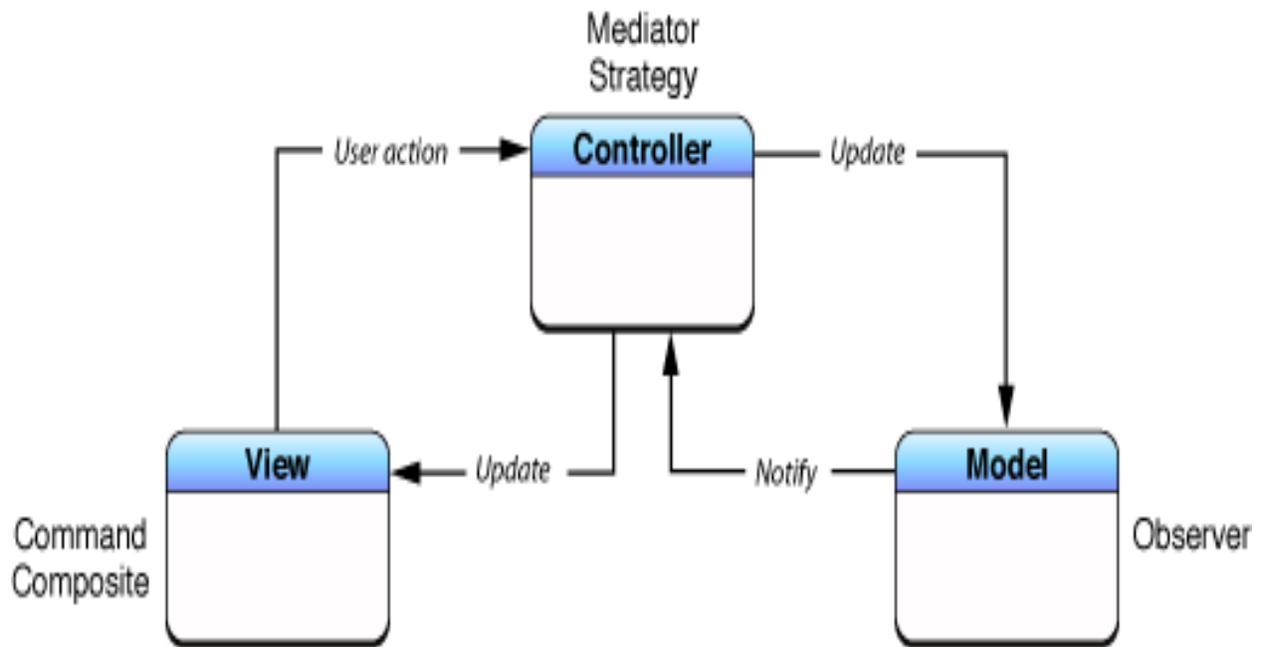


Figure 3-4. Shows the workflow of iOS programs. Highlights how the three components of an application work together, View, Controller, Model.

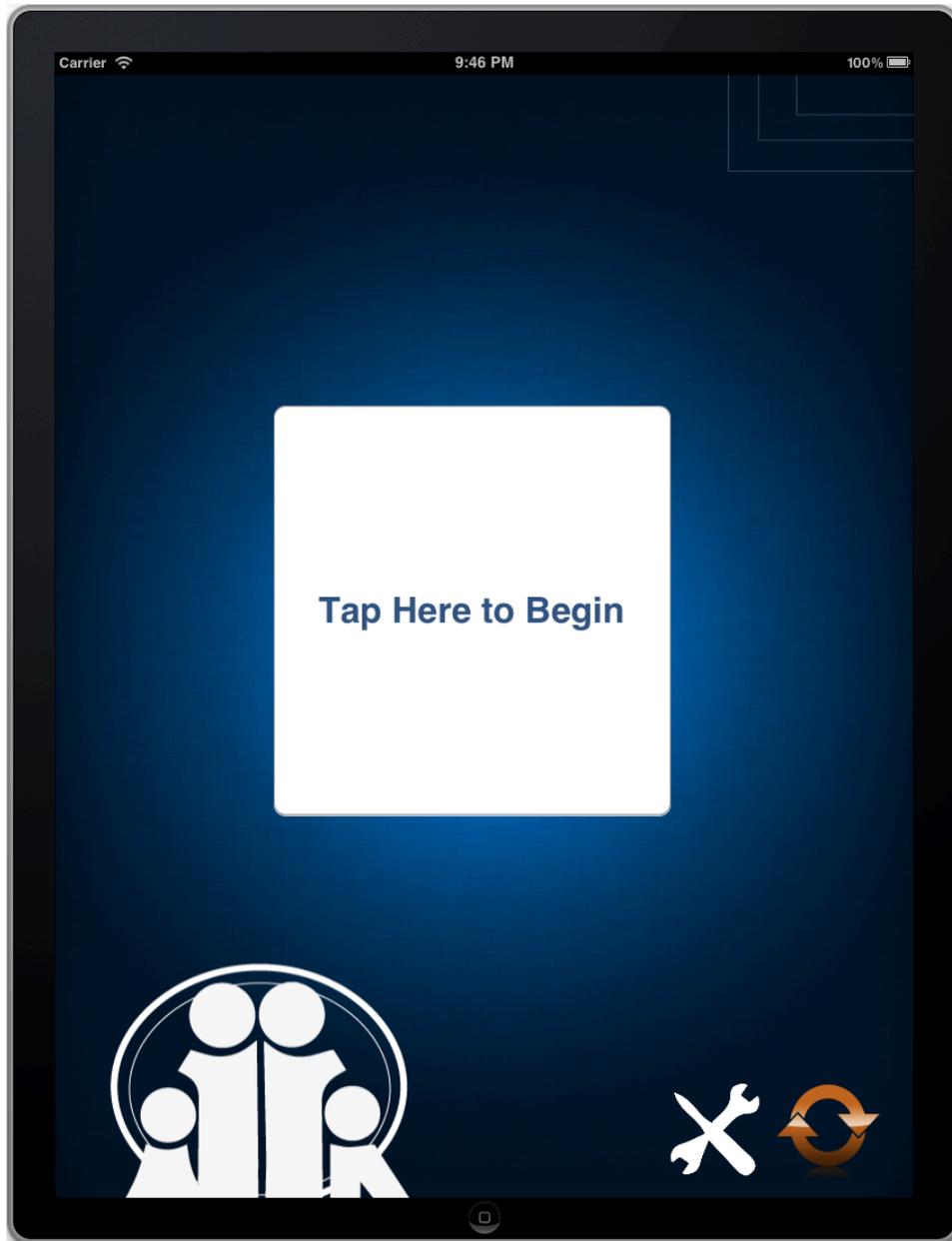


Figure 3-5. Shows Family Connect's Main Menu. Here the participant can click the big button "Tap Here to Begin" to start the quiz. The bottom right orange button refreshes the quiz. The tools button goes to the settings menu.

```

60
61 - (IBAction)startQuizButton:(id)sender {
62     AppDelegate* appDelegate = [AppDelegate sharedApplication];
63
64
65     NSLog(@"noData, :%d", appDelegate.noData);
66
67     if (appDelegate.noData == 0) {
68         ViewController *VC = [[ViewController alloc] initWithNibName:nil bundle:nil];
69         [self presentViewController:VC animated:YES completion:nil];
70     } else {
71         imageWarningLabel.alpha = 1.0;
72
73
74
75         NSLog(@"NO XML DOC");
76     }
77 }
78 }
79
80 - (IBAction)adminSettingsButton:(id)sender {
81     SettingsViewController *SVC = [[SettingsViewController alloc] initWithNibName:nil bundle:nil];
82     [self presentViewController:SVC animated:YES completion:nil];
83 }
84

```

Figure 3-6. Shows the splashview.m file. Displays the IBAction to start the quiz.

Figure 3-7. (below) Shows the quiz.m file. Here we see the steps the quiz takes when loading. It resets the answers from previous quizzes, sets the ID, loads the question, randomly shuffles the 4 images for the question and then assigns them to the buttons.

```

55
56 - (void)viewDidLoad
57 {
58     [super viewDidLoad];
59
60     //SET INITIAL PARAMETERS
61     theTDAnswer = [[TDAnswer alloc] init];
62     score = 0;
63     wrongCounter = 0;
64     wrongIndividualQuestion = 0;
65     answers = [[TDAnswerStore sharedInstance] fetchAllAnswers];
66
67     //QUIZ ID SET
68     [self fetchQuizID];
69
70     // LOAD QUESTIONS FROM DATA
71     [self loadQuestion];
72
73     // SHUFFLE OUR RANDOM ARRAY FOR BUTTON IMAGES
74     randomQuestionIndex = [self reshuffleArray:4];
75     randomImageIndex = [self reshuffleArray:incorrectImageTotal];
76
77
78     // ASSIGN PICTURES TO BUTTONS & MIX THE ARRAYS
79     [self assignButtons];
80
81 }
82

```

```

357
358 //EASY SETTING
359 if (difficulty == 0) {
360
361     //FETCH ALL IMAGES|
362     incorrectImages = [[TDImageStore sharedStore] fetchEasyImages];
363     questions = [[TDQuestionStore sharedStore] fetchAllQuestions];
364     incorrectImageTotal = [incorrectImages count];
365
366     //Set Difficulty Label
367     difficultyLabel = @"Easy";
368     [theTDAnswer setQuestionDifficulty:difficultyLabel];
369

```

Figure 3-8. Shows the quiz calling the TDQuestionStore to grab all the questions. Once the array of questions is called, the computer displays the first object in that array, i.e. Question #1. This also shows the computer grabbing the incorrect images from the ImageStore.

```

595
596 -(void)assignButtons
597 {
598
599     //Reset WrongCounter
600     wrongScore = 0;
601     wrongCounter = 0;
602     NSLog(@"question Image is %@", [[questions objectAtIndex:currentQuestion] questionImage]);
603
604     //MIX ARRAY
605     correctPictureOne = [[questions objectAtIndex:currentQuestion] questionImage];
606     randomPictureOne = [[incorrectImages objectAtIndex:[randomImageIndex objectAtIndex:0] integerValue] imagePic];
607     randomPictureTwo = [[incorrectImages objectAtIndex:[randomImageIndex objectAtIndex:1] integerValue] imagePic];
608     randomPictureThree = [[incorrectImages objectAtIndex:[randomImageIndex objectAtIndex:2] integerValue] imagePic];
609
610     //SET ANSWER IMAGE FOR TDAnswerStore
611
612     [theTDAnswer setAnswerImage:[[questions objectAtIndex:currentQuestion] imageURL]];
613     [theTDAnswer setQuestionGender:[[questions objectAtIndex:currentQuestion] gender]];
614     [theTDAnswer setQuestionRace:[[questions objectAtIndex:currentQuestion] race]];
615     [theTDAnswer setQuestionAge:[[questions objectAtIndex:currentQuestion] age]];
616     [theTDAnswer setQuestionHair:[[questions objectAtIndex:currentQuestion] hair]];
617     [theTDAnswer setQuestionPersonName:[[questions objectAtIndex:currentQuestion] personName]];
618     [theTDAnswer setQuestionAnsNumber:currentQuestion +1 ];
619
620
621
622     mixQuestions = [[NSMutableArray alloc] init];
623     [mixQuestions addObject:correctPictureOne];
624     [mixQuestions addObject:randomPictureOne];
625     [mixQuestions addObject:randomPictureTwo];
626     [mixQuestions addObject:randomPictureThree];
627

```

Figure 3-9. Shows the quiz taking the 3 incorrect images (“randomPictureOne”, “Two” and “Three”) as well as the correct image and putting them into an array called mixQuestions. This allows the questions to be randomly shuffled and assigned to buttons. This way, the images do not show up on the same button every time the quiz is taken. You also see the correct image attributes being added to the TDAnswer Store, which allows it to be saved once the quiz is completed. (i.e. the image’s gender, race, image URL, hair and name.)

```

373 } else {
374     // MEDIUM SETTING
375     if (difficulty == 1) {
376         questions = [[TDQuestionStore sharedStore] fetchAllQuestions];
377         NSPredicate *racePred = [NSPredicate predicateWithFormat:@"%race == %@", [[questions objectAtIndex:currentQuestion] race]];
378         NSPredicate *genderPred = [NSPredicate predicateWithFormat:@"%gender == %@", [[questions objectAtIndex:currentQuestion] gender]];
379         NSPredicate *compPred = [NSCompoundPredicate andPredicateWithSubpredicates:@[racePred,genderPred]];
380         incorrectImages = [[TDImageStore sharedStore] fetchMediumImagesWithPredicate:compPred];
381
382         if ([incorrectImages count] < 3) {
383             incorrectImages = nil;
384
385             incorrectImages = [[TDImageStore sharedStore] fetchEasyImages];
386             questions = [[TDQuestionStore sharedStore] fetchAllQuestions];
387             incorrectImageTotal = [incorrectImages count];
388
389             //Set Difficulty Label
390             difficultyLabel = [[NSMutableString alloc] initWithString:@"Easy"];
391             // NSLog(@"DIFFICULTY 2 %@", difficultyLabel);
392             [theTDAnswer setQuestionDifficulty:difficultyLabel];
393
394         } else {incorrectImageTotal = [incorrectImages count];}
395
396         //Set Difficulty Label
397         difficultyLabel = [[NSMutableString alloc] initWithString:@"Medium"];
398         //NSLog(@"DIFFICULTY 2 %@", difficultyLabel);
399         [theTDAnswer setQuestionDifficulty:difficultyLabel];
400
401     } else {
402         // HARD SETTING
403     }
404 }
405

```

Figure 3-10. Shows the quiz finding the difficulty settings. If it is set to “1” in the settings, it will grab all of the images from the incorrect image Store and sort only the ones that match the correct image’s “Race” and “Gender”. If there are no images that match, it reduces the settings by “1” and grabs all the incorrect images. In this case, “medium” would drop to “easy” if there were no attribute matches.

ENTITIES	
<b>E</b> Question	
<b>E</b> Quiz	
FETCH REQUESTS	
CONFIGURATIONS	
<b>C</b> Default	

Attributes		
Attribute	Type	
<b>N</b> incorrectScore	Integer 16	▲▼
<b>N</b> quizConnection	Integer 16	▲▼
<b>N</b> quizID	Integer 16	▲▼
<b>N</b> masterScore	Double	▲▼
<b>N</b> questionTotal	Double	▲▼
<b>S</b> overallDifficulty	String	▲▼
<b>D</b> timeDate	Date	▲▼
<b>D</b> totalTime	Date	▲▼

Figure 3-11. Shows the quiz entity that has eight attributes. In addition, every question answered becomes an entity saved in Core Data and it too has several individual attributes.

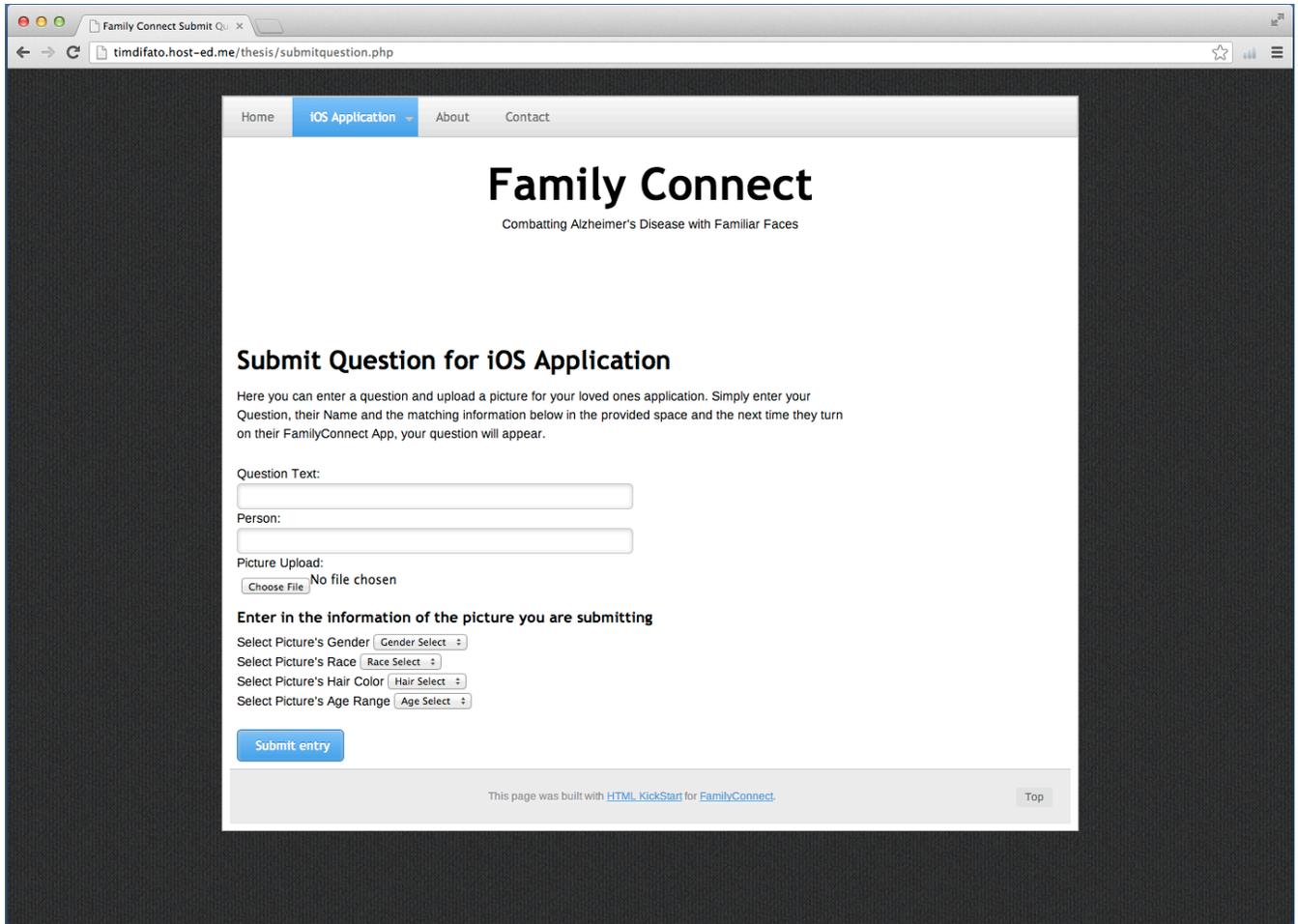


Figure 3-12. Shows the website where you can submit questions and images to the iPad app. Click here to visit page: <http://timdifato.host-ed.me/thesis/submitquestion.php>

```

1  <?xml version="1.0"?>
2  <Quiz>
3    <Question id="1">
4      <Questiontext>Hi Edie, its me Kathleen. Tap the picture of me.</Questiontext>
5      <Image>http://timdifato.host-ed.me/thesis/pictures/1.jpg</Image>
6      <Person>Kathleen Difato</Person>
7      <Gender>Female</Gender>
8      <Race>White</Race>
9      <Hair>Black</Hair>
10     <Age>Mid</Age>
11   </Question>

```

Figure 3-13. Shows the XML document created by entering information and uploading images to the website. This is what the application reads every time it loads.

```
260 //if there is no error ends here
261 else //if submitted but there are errors
262 {
263
264     echo '<div class="notice error"><i class="icon-remove-sign icon-large"></i> Entry Error. Please Try Again.
265     <a href="#close" class="icon-remove"></a></div>';
266
267 }
268
269 }//if submitted ends here
```

Figure 3-14. Shows the PHP script error which is revealed if information on the website is not entered in correctly.

pictures	Directory	03/29/2013 16:35:22
About.php	2,975 php-file	03/24/2013 15:28:59
FamilyConnect.sqlite	28,672 sqlite-file	03/29/2013 01:07:52
bigPicture.JPG	2,413,613 JPEG Picture	03/29/2013 16:28:36
db.php	154 php-file	03/24/2013 15:28:59
error_log	4,449 File	03/29/2013 16:24:42
gallery.php	2,420 php-file	03/24/2013 18:34:30
index.php	3,915 php-file	03/24/2013 15:35:58
numofquestions.txt	2 ASCII Text	03/29/2013 16:35:37
questions.xml	3,563 xml-file	03/29/2013 16:38:30
style.css	1,962 css-file	03/18/2013 18:02:49
submitquestion.php	10,023 php-file	03/29/2013 16:27:35
tim.jpeg	101,349 JPEG Picture	03/18/2013 18:03:00

Figure 3-15. Shows the server. Here you can see the database file being stored, (FamilyConnect.sqlite) as well as all of the .php files to run the website.

Figure 3-16a. Shows Sample 1, “Dark Blue” design for the application.

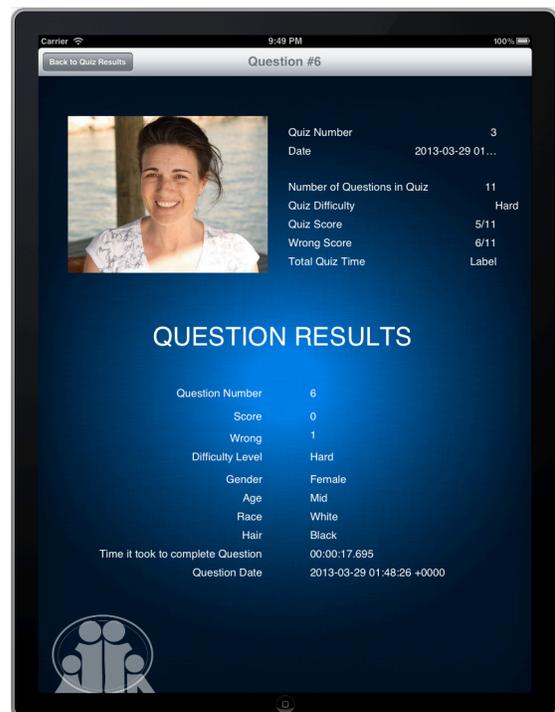
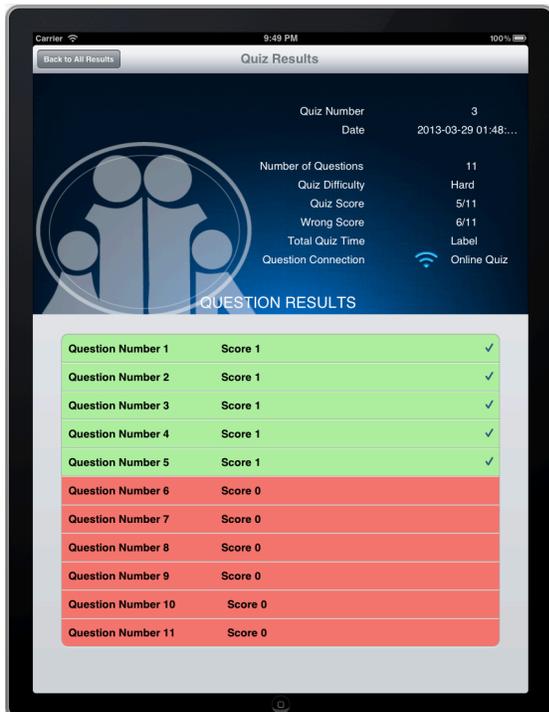
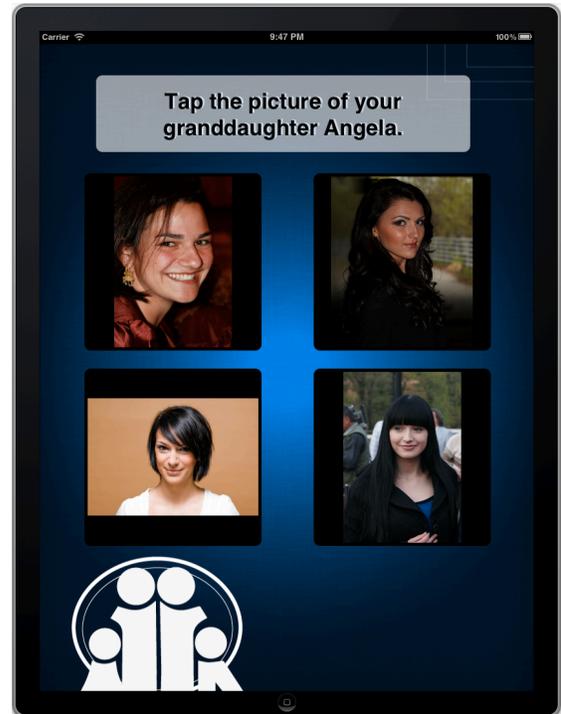
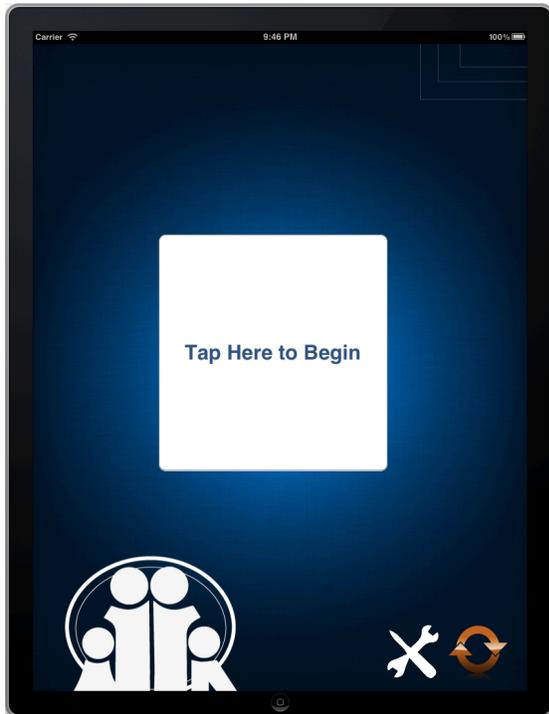


Figure 3-16b. Shows Sample 2, “Lite Blue” design for the application.

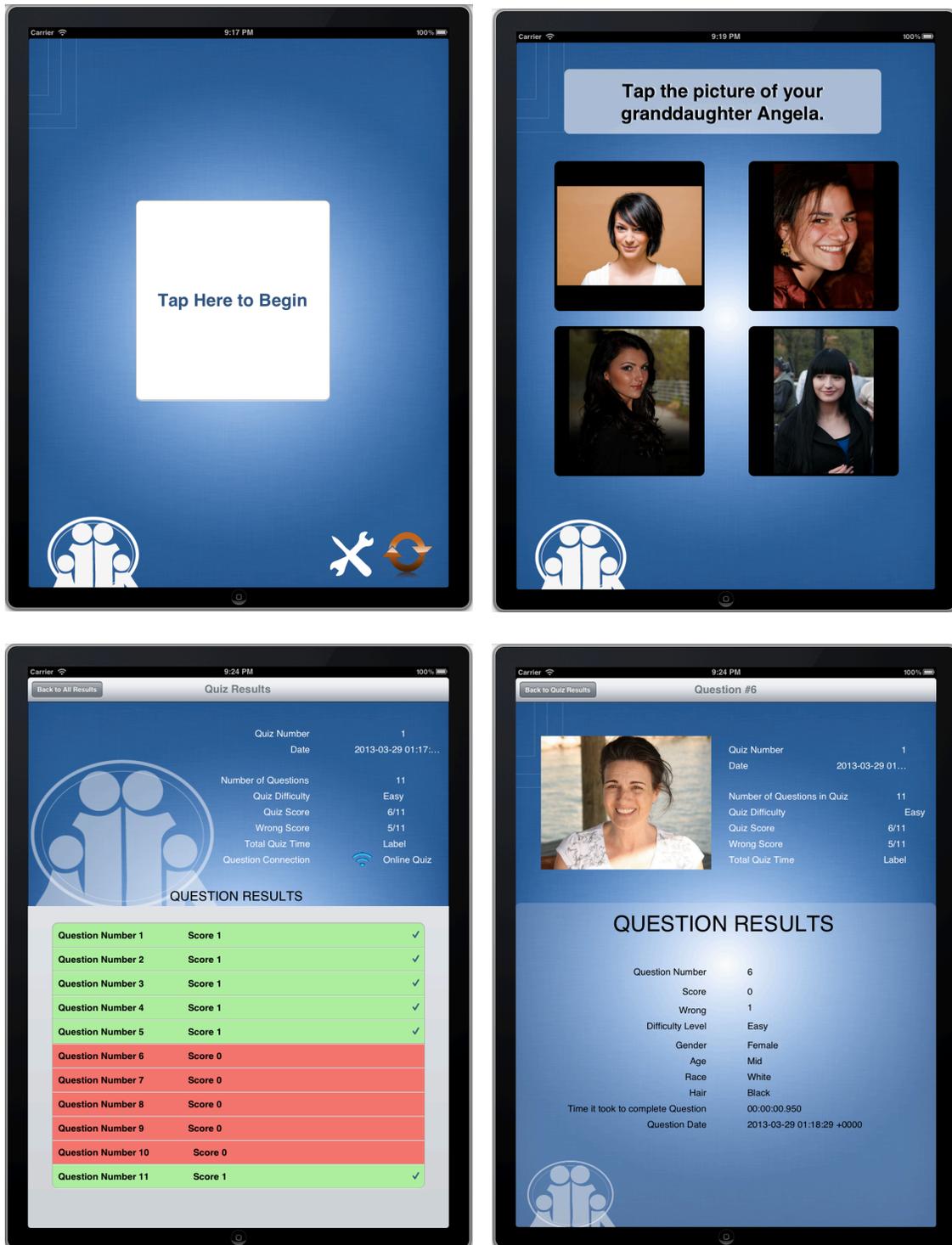


Figure 3-16c. Shows Sample 3, “Lite Green” design for the application.

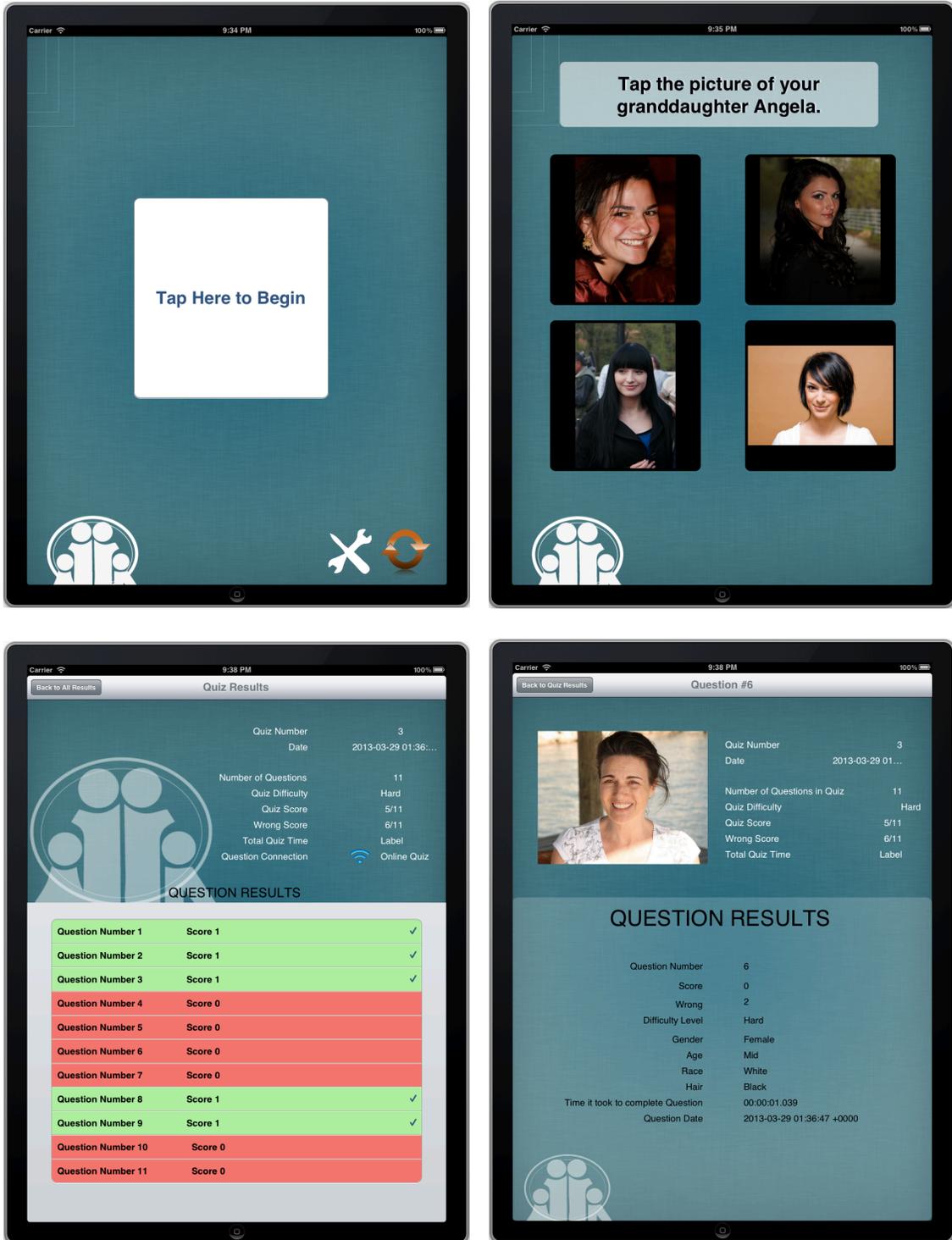


Figure 3-17. Shows the opening load screen for sample 2, "Lite Blue" design.

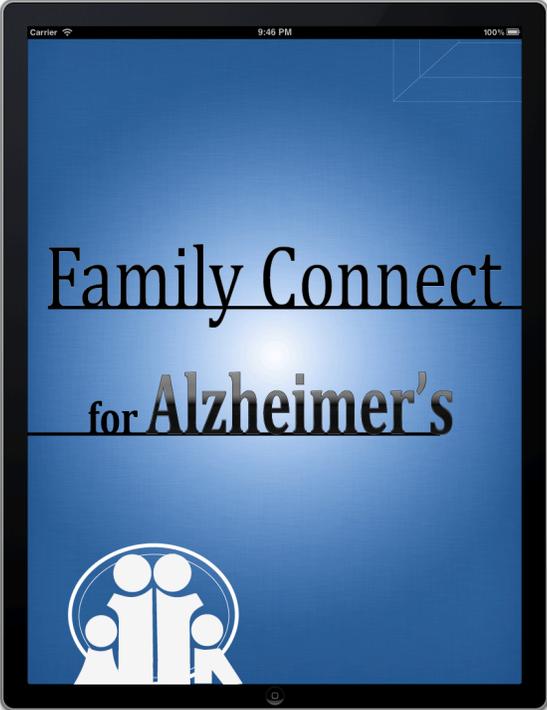


Figure 3-18. Shows the first Dropbox.com homepage design.



## CHAPTER 4 MARKETING RESEARCH

### **Market Demand**

Today, an estimated 5.4 million Americans are living with Alzheimer's disease with that number estimated to increase by 10 million more people in response to the aging of the baby boomer generation. In America, every 68 seconds a person develops Alzheimer's disease. <sup>[11]</sup> Currently, AD is one of the top leading killers in the United States, coming in as the sixth leading cause of death to the general population and the fifth leading cause of death for those ages 65 and up. In recent years, the majority of serious diseases, other than AD, that lead to death have dropped significantly, where as AD related deaths have risen. The Alzheimer's Association reports that deaths due to heart disease, stroke and prostate cancer have all been reduced by "13%, 20%, and 8%, respectively, where as the proportion due to AD increased by 66%," <sup>[11]</sup> between the years of 2000-2008. [\[Figure 4-1\]](#)

The market for an Alzheimer's disease solution is enormous and increasing. Currently, there are few non-medical solutions to combat AD and even fewer drug related solutions. The 2012 expected cost of AD healthcare, hospice care and long term care totals \$200 billion which does not account for the estimated 17.4 billion unpaid family member hours used to care for loved ones. Medically, the United States Food and Drug Administration has approved five drugs that bring temporary relief. These drugs reduce the average signs and symptoms of AD but have varying results. No drug-induced treatment today changes the outcome of the disease.

## Target Market

As discussed in earlier sections of this thesis, Family Connect for Alzheimer's can be used by people in all stages of the disease. The application can be used as a preventative tool by strengthening the mind or it can be used to help combat advanced forms of AD to help the patients who may have already forgotten their loved ones. With that said, the application's target market is patients with mild to severe Alzheimer's, specifically stages 3-7.

Mid to late stages of Alzheimer's is where patients start to heavily rely on their caregiver. One woman I interviewed stated, "there were times when I would find him with his face in his hands crying and saying, why can't I think like I use to." This man was diagnosed to have stage 4 Alzheimer's. Because family members do not notice most of the early stages of AD, the average patient first sees a doctor around stages 2-3. This stage of AD is the most common and most people diagnosed with AD do not live long enough to progress into the deepest stages of the disease. The 2012 Alzheimer's Disease Facts and Figures report states that, "...people 65 and older survive an average of four to eight years after diagnosis of Alzheimer's disease." [12]

The target areas to market this product would be the state of Florida, Texas and California as they have the highest mortality rate due to Alzheimer's disease as well as the highest projected percentage increase of people diagnosed with AD. [Figure 4-2] [Figure 4-3]

With the baby boomer generation reaching retirement, more and more people are going to be thrown into the lottery for developing Alzheimer's. Projections show that by the year 2050 there will be nearly 21 million Americans aged 85. This nearly

quadruples the current population of people 85 and older. Currently, 2.5 million people 85 years or older have Alzheimer's disease which will increase to an estimate 3.5 million when the baby boomers reach 85.

Demographically, it is believed that women are nearly twice as likely to be diagnosed with Alzheimer's disease than men. <sup>[Figure 4-4]</sup> Similarly, African-Americans and Hispanics aged 85 and above are two times more likely to be diagnosed with Alzheimer's than Caucasians. <sup>[Figure 4-5]</sup> With that said, the 2009 census shows that the average Caucasian income was almost double that of people classified as Hispanic or Black.<sup>[13]</sup> This number would suggest that the former two races would have less disposable income at retirement and less likely to purchase the technology to use the application. But as technology continues to advance, former technology price points become reduced.

### **Competitors**

Currently, there are few competitors in the market for Alzheimer's solutions. Family Connect's direct competitors are considered any computer based Alzheimer solution or awareness application, ranging from brain strengthening quizzes to alarm reminding software.

#### **Focus App Store:**

Focus App Store is an application that educates users on certain neurological diseases. Focus App Store made by Focus Applications educates people on how certain diseases affect the body. Simply put, the application is defined as medical educating software. It provides animated videos to help explain complex issues,

informing regular people about the impacts of certain diseases. The application also provides medical treatment and best practice information. This application allows a free download and gets sales once users are inside the app. Here the users can purchase disease specific modules such as stroke or Alzheimer's.

Focus Applications promotes their app as free medical educating software specifically for AD. Once inside the app, each module costs \$9.99. The iTunes App Store shows several customers who rated this 1 star due to falsely advertising this product as a free application. Without paying \$9.99, Focus App Store is a useless application, as it has nothing to present on its own. [\[Figure 4-6\]](#)

### **Brain Map:**

Brain map is an application that allows users to view and discover the brain through 3D models. The app educates and brings awareness to how a disease affects the brain. It allows you to take a picture of your head and it will show you what your brain looks like on the inside. The application simply super imposes an image on top of your image taken from the devices camera. Brain Map was created by the Alzheimer's Society to help educate and bring awareness. It is a free application with several 5 star reviews on the iTunes store. It is solely built for the iPhone and iPad. [\[Figure 4-7\]](#)

### **Alzheimer Cards**

The application "Alzheimer Cards", was built by Tracey Valleau, a caregiver who used flash cards to help Alzheimer's patients with their memory. Taken from the book "Simple Pleasures for Special Seniors", the app uses generic house hold images that help start conversations between people with AD and their caregivers. The app is a simple slide

show of images such as oranges, apples, cars and other common daily objects. These images are supposed to help jog a person's memory by making associations with the objects in the pictures and past events. The application is only for the iOS and is priced at \$1.99. It has an average review from users of 3/5 stars due to frequent crashes and lack of content. Users do appreciate the application for its ability to create conversation and add an event to the daily routine for AD patients.

The problem with apps developed by non-technical professionals is that they do not send out frequent updates to match the operating system updates. Currently, this app crashes on start up because it is not compatible with newer iOS versions. [\[Figure 4-8\]](#)

### **Brainy App**

Brainy App is a preventative Alzheimer's application. It is an app built to workout someones mind through brain games. It is created by Alzheimer's Disease Australia and Bupa Health Foundation as preventive neurological disease software. This was the first health preventative Alzheimer's application created for mobile devices. It is yet to be discovered if this application truly works, but the idea is that if a person keeps their mind and heart healthy, they will have greater odds of dodging AD. The companies slogan is, a healthy heart equals a healthy mind. The app combines a fun, game centered mechanic to monitor and address health issues at a person's current age. This application created a huge press following in Australia and by far is the most concise, clean and interactive application out of the list of competitors. It has had over 200,000 downloads and is ported to iOS and Android devices.

This application has won several awards such as #1 Health and Lifestyle application and #1 Australian app. The application is free and has 5 stars by users. This

application's target market is 30-40 year old people who are looking for interactive, simple solutions for preventing future neurological diseases. [\[Figure 4-9\]](#)

### **It's Done!**

It's Done! was created by a home user who wanted software to help his father remember certain tasks he had completed throughout his day. The application allows for custom-built events to be added to a daily checklist such as taking out the trash or checking the mail. Once the task is completed, the participant would check it off his list. This application is a simple daily living tool. It does not aid in recovery or try to impede the affects of the disease.

The application is priced at \$2.99 and has not received enough downloads or ratings to be given a general rating. [\[Figure 4-10\]](#)

### **What day is it?**

What day is it? is a PC based software that turns a computer monitor into a reminder board. It posts the date, a message and plays friendly music so that the patient can remember certain tasks. The application can provide a single picture at a time as a backdrop with a message such as "This is Steve". It has several modes such as slideshow, holiday and event, which displays specific info the caregiver wants the patient to remember. The application is simply a computer monitor turned into a static picture frame. The application can be downloaded online at a purchase price of \$39.

[\[Figure 4-11\]](#)

## Family Connect User-Testing

For a one-week period, I took this application to several homes and surveyed people from a wide spectrum of ages, ranging from 20-90 years old. There were two types of survey participants I took in this test. The first survey was taken by people who agreed to take the full test which meant uploading their families pictures and questions. This group was much smaller in size, consisting of three people and they took their personalized quiz several times. The second group was given an overall general quiz, which they only took once.

Each individual of the first group took the quiz on an iPad at their home. The questions and pictures were preloaded to the website. The quiz was taken in the presence of a quiz administrator to observe behavior and interaction with the application. After the quiz was taken, the administrator asked the individuals certain questions from a survey document. [\[Figure 4-12\]](#) The three test takers from group one were over 80 years old and do not have any mental disorder or disease. This test was simply to see how elderly people interacted with the application and their response to seeing familiar faces throughout the quiz duration.

The overall response was positive. Every participant nearly aced the quiz. The button layout seemed intuitive and easy for the participants to use. They quickly understood the logic of the game and how to submit answers. The questions submitted were written with certain intent to see how participants reacted. Some were very impersonal and direct, "Select the picture of Steve", while others were personal and sincere such as, "Hi mom, it's me Jack. Tap the picture of me. I love you". The personal message seemed to draw a physical showing of emotion on every participant. The task

of taking the quiz became enjoyable and reminiscent where as the impersonal questions were answered almost immediately with no sign of fondness.

Two of the participants had used an iPad before and understood the basics of waking up the iPad by sliding the “unlock bar” to the right to be able to access the application. The other participant struggled figuring out how to use the iPad but once that user was in the application, they progressed rapidly through the quiz due to key phrases such as, “press the image” or “tap the picture”. They were all given the basic dark blue color scheme. [\[Figure 4-13\]](#) All of them said they could easily read the text and see the pictures. In addition, all of the participants knew someone with AD and gave wonderful feedback. To view the results of their testing see figure 4-14. [\[Figure 4-14\]](#)

Due to time and the lack of iPad testing units, only one of the participants was given the application to use for a 1-week period while the other two were given the quiz for a 1-day period. This user is 83 years old and lives alone. The only error or bug she encountered throughout the week was remembering to plug in the iPad to recharge the battery. She managed to take the test daily without any errors or issues. In this time period, no new images or questions were added to the quiz. One question she asked was what would happen if she took the quiz and she had to leave. This was wonderful feedback, as I never assumed a person would leave the quiz unless finished. If a person were to leave, they could simply click the “HOME” button built into each iPad. Once they return, all they have to do is reopen the Family Connect app and the quiz will pickup right where they left off. The purpose of this test was to see if the application would run smoothly without an administrator present.

The second group was composed of randomly selected people to take the quiz and compare the design styles. The generic quiz that was given to the participants is programmed into the main application in case the iPad does not have Internet access to grab the personalized questions and images. The generic quiz asks about common people everyone in the United States should know such as, the Presidents of the United States. In this study, I was simply trying to find the best UI design layout for elderly people and if younger people would use this to help their grandparents with AD. The results were very interesting. As described earlier, younger people chose a lighter layout, while the older generation chose the darker one. This coincides with the research given by the OMD marketing group that states dark layouts with lighter text are easier for elderly eyes. Images are less likely to be blown out by the backgrounds color and light, which makes it easier to focus on.

Several constructive results showed that the buttons in my beta design were too close in proximity and people would either accidentally hit the wrong one or it would take them a long time to look from picture to picture. After spacing the images, the design became much cleaner. To view the results of the second study group, view [figure 4-15](#) and [figure 4-16](#). [\[Figure 4-15\]](#) [\[Figure 4-16\]](#)

## **Conclusion**

Though my user-testing sample was small, I gained invaluable information. For future work in this field, I look forward to sampling a larger population to find more concrete data and evidence towards the apps design and functionality. Alzheimer's disease is an ever-growing medical issue that affects millions of lives. Doctors and

researchers need large amounts of data to find patterns and implement cures while in the meantime patients and caregivers need comfort and relief. Though Family Connect for Alzheimer's may not directly destroy the disease, it is a tool to help combat Alzheimer's while bringing comfort to patients by using familiar faces.

Figure 4-1. Shows the percentage changes in selected causes of Death. [19]

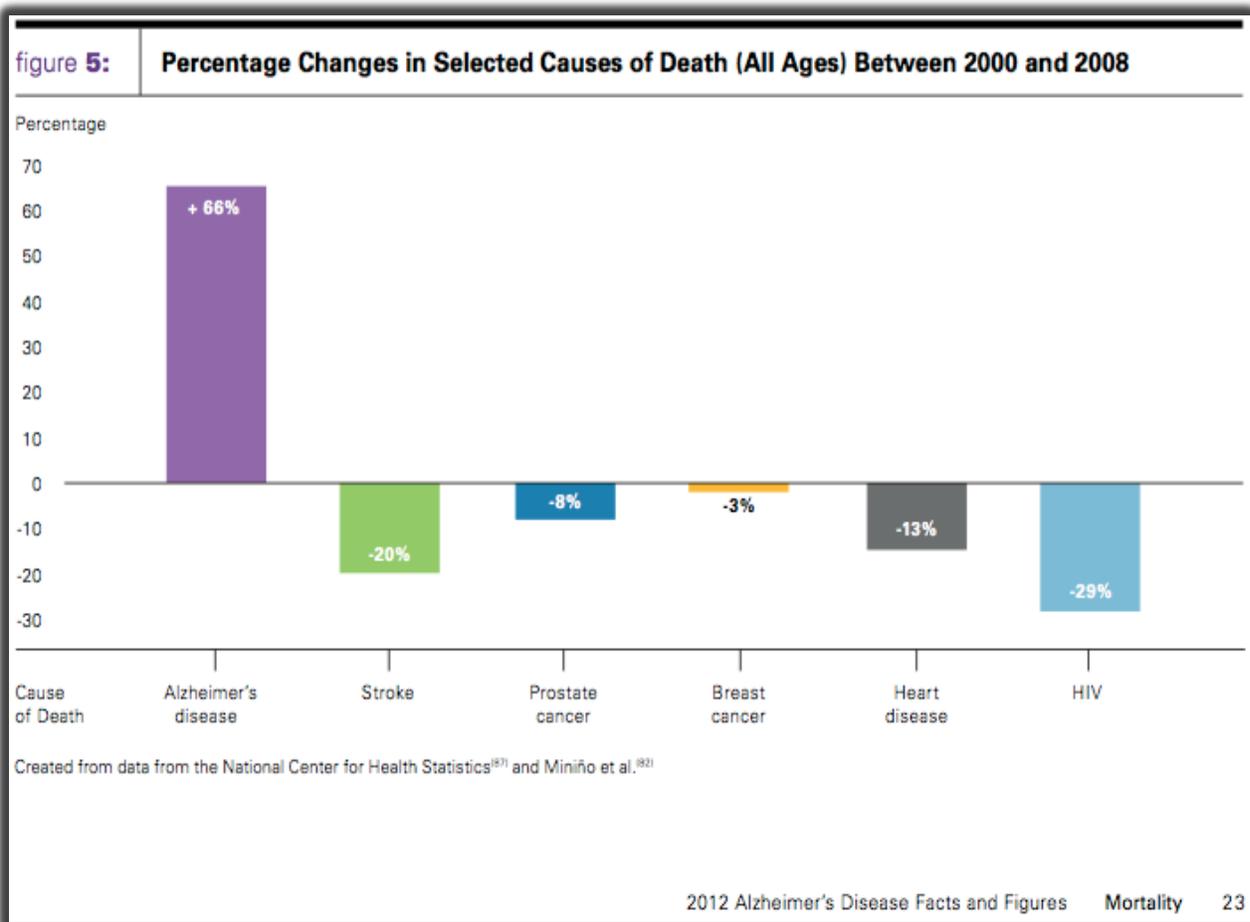


Figure 4-2. Shows the number of deaths due to Alzheimer's sorted by State. [20]

State	Number of Deaths	Rate	State	Number of Deaths	Rate
Alabama	1,518	32.6	Montana	294	30.4
Alaska	80	11.7	Nebraska	610	34.2
Arizona	2,099	32.3	Nevada	279	10.7
Arkansas	893	31.3	New Hampshire	393	29.9
California	10,098	27.5	New Jersey	1,857	21.4
Colorado	1,353	27.4	New Mexico	366	18.4
Connecticut	839	24.0	New York	2,303	11.8
Delaware	204	23.4	North Carolina	2,624	28.5
District of Columbia	132	22.3	North Dakota	312	48.6
Florida	4,743	25.9	Ohio	4,285	37.3
Georgia	1,929	19.9	Oklahoma	1,061	29.1
Hawaii	218	16.9	Oregon	1,302	34.4
Idaho	393	25.8	Pennsylvania	3,863	31.0
Illinois	3,192	24.7	Rhode Island	359	34.2
Indiana	1,971	30.9	South Carolina	1,492	33.3
Iowa	1,332	44.4	South Dakota	402	50.0
Kansas	961	34.3	Tennessee	2,423	39.0
Kentucky	1,370	32.1	Texas	5,280	21.7
Louisiana	1,361	30.9	Utah	409	14.9
Maine	450	34.2	Vermont	218	35.1
Maryland	1,016	18.0	Virginia	1,763	22.7
Massachusetts	1,832	28.2	Washington	3,105	47.4
Michigan	2,739	27.4	West Virginia	662	36.5
Minnesota	1,344	25.7	Wisconsin	1,655	29.4
Mississippi	916	31.2	Wyoming	125	23.5
Missouri	2,010	34.0	<b>U.S. Total</b>	<b>82,435</b>	<b>27.1</b>

Created from data from Miniño et al.<sup>[20]</sup>

Figure 4-3. Shows the projected percentage increase of people diagnosed with AD. [21]

State	Projected Total Numbers (in 1,000s) with Alzheimer's			Percentage Change in Alzheimer's (Compared with 2000)	
	2000	2010	2025	2010	2025
New Mexico	27.0	31.0	43.0	15	59
New York	330.0	320.0	350.0	-3	6
North Carolina	130.0	170.0	210.0	31	62
North Dakota	16.0	18.0	20.0	13	25
Ohio	200.0	230.0	250.0	15	25
Oklahoma	62.0	74.0	96.0	19	55
Oregon	57.0	76.0	110.0	33	93
Pennsylvania	280.0	280.0	280.0	0	0
Rhode Island	24.0	24.0	24.0	0	0
South Carolina	67.0	80.0	100.0	19	49
South Dakota	17.0	19.0	21.0	12	24
Tennessee	100.0	120.0	140.0	20	40
Texas	270.0	340.0	470.0	26	74
Utah	22.0	32.0	50.0	45	127
Vermont	10.0	11.0	13.0	10	30
Virginia	100.0	130.0	160.0	30	60
Washington	83.0	110.0	150.0	33	81
West Virginia	40.0	44.0	50.0	10	25
Wisconsin	100.0	110.0	130.0	10	30
Wyoming	7.0	10.0	15.0	43	114

Created from data from Hebert et al.<sup>178, A10</sup>

Figure 4-4. Estimated lifetime Risks for AD by Age and Gender. [22]

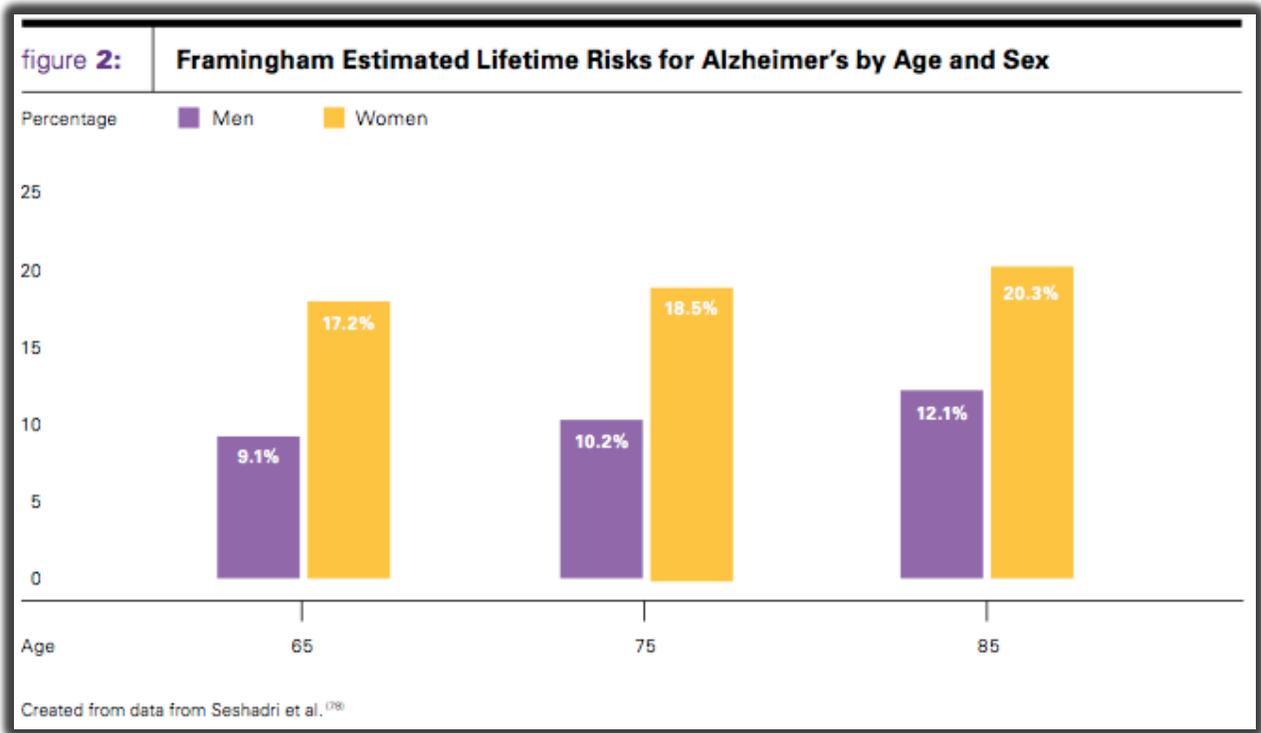


Figure 4-5. Proportion of AD sorted by Race. [23]

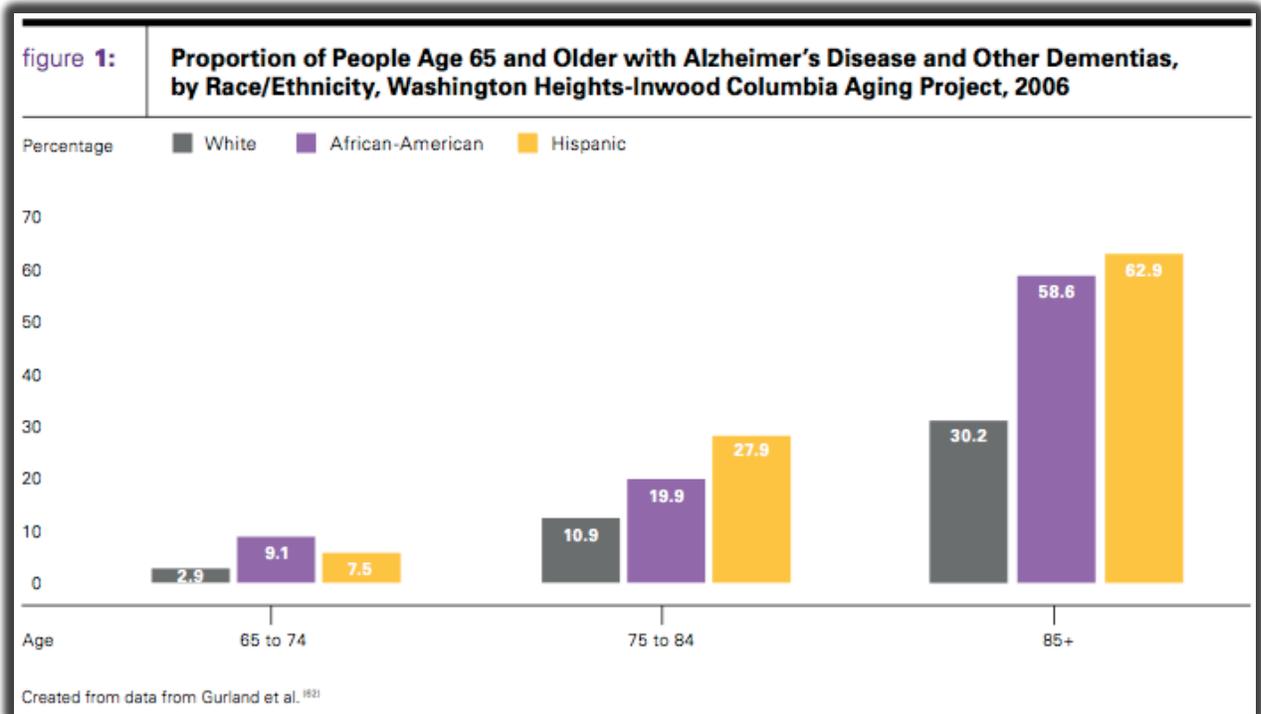


Figure 4-6. Displays screen shots of Focus Application.

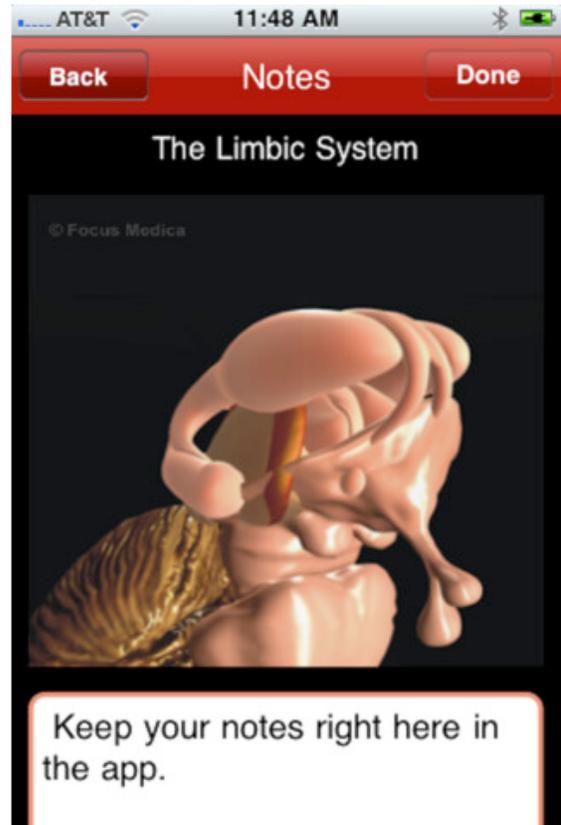
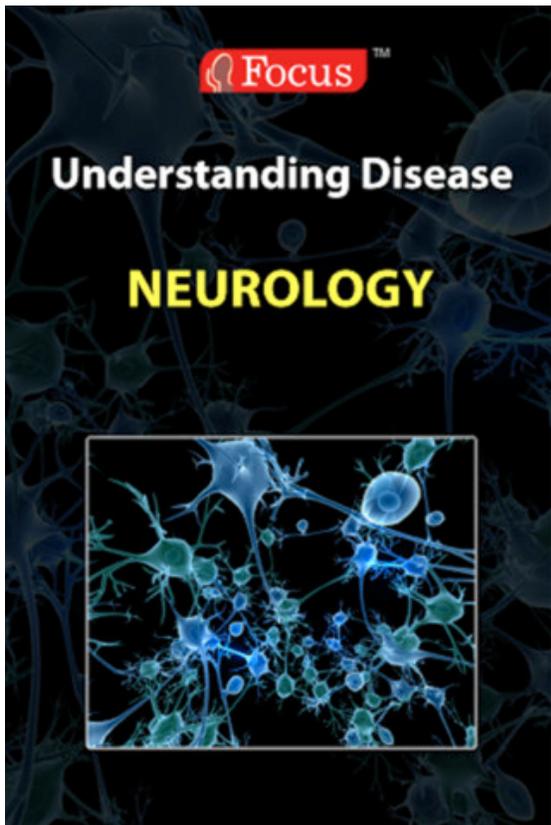


Figure 4-7. Displays screen shots of Brain Map.

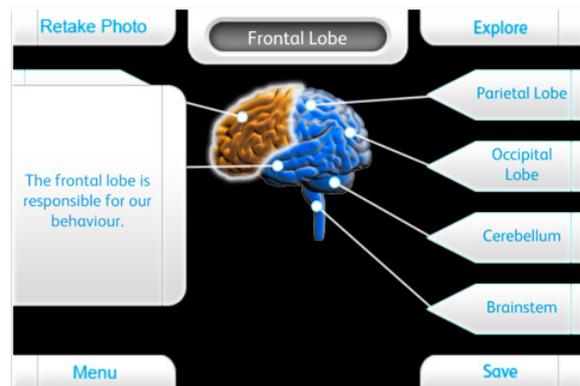
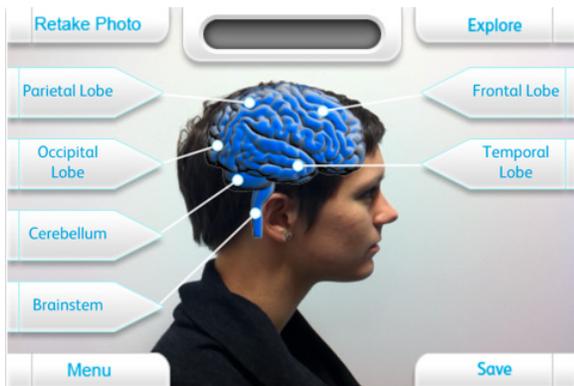


Figure 4-8. Displays screen shots of Alzheimer Cards.

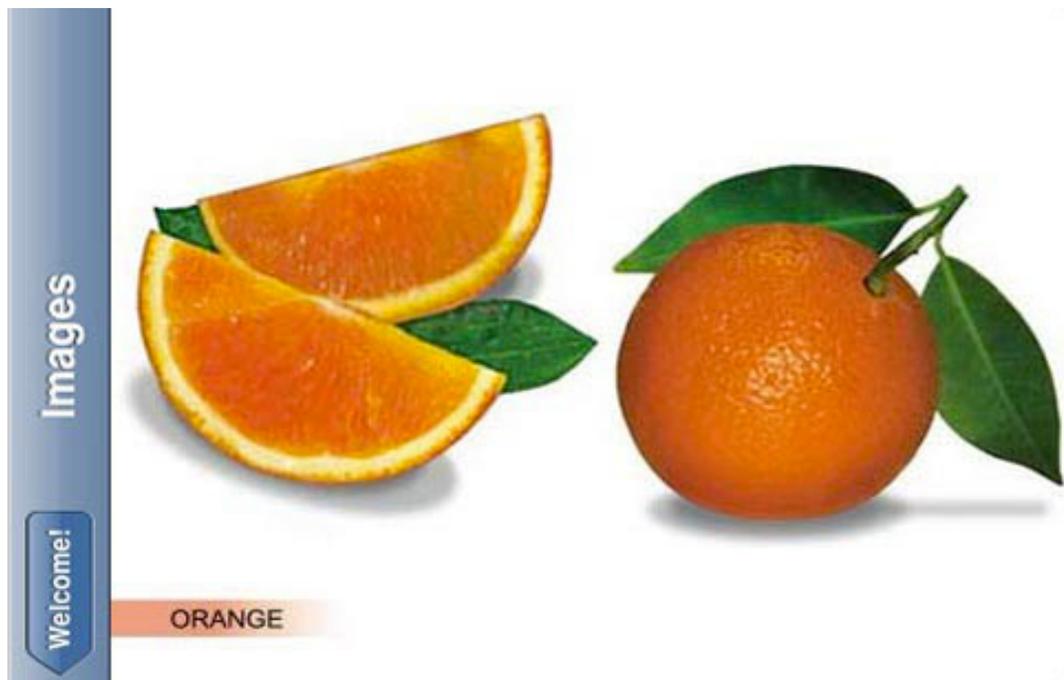
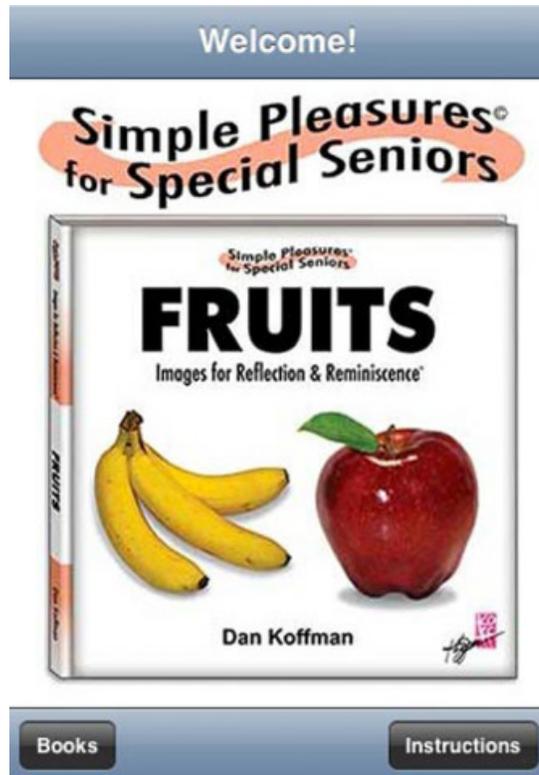


Figure 4-9. Displays screen shots of Brainy App.

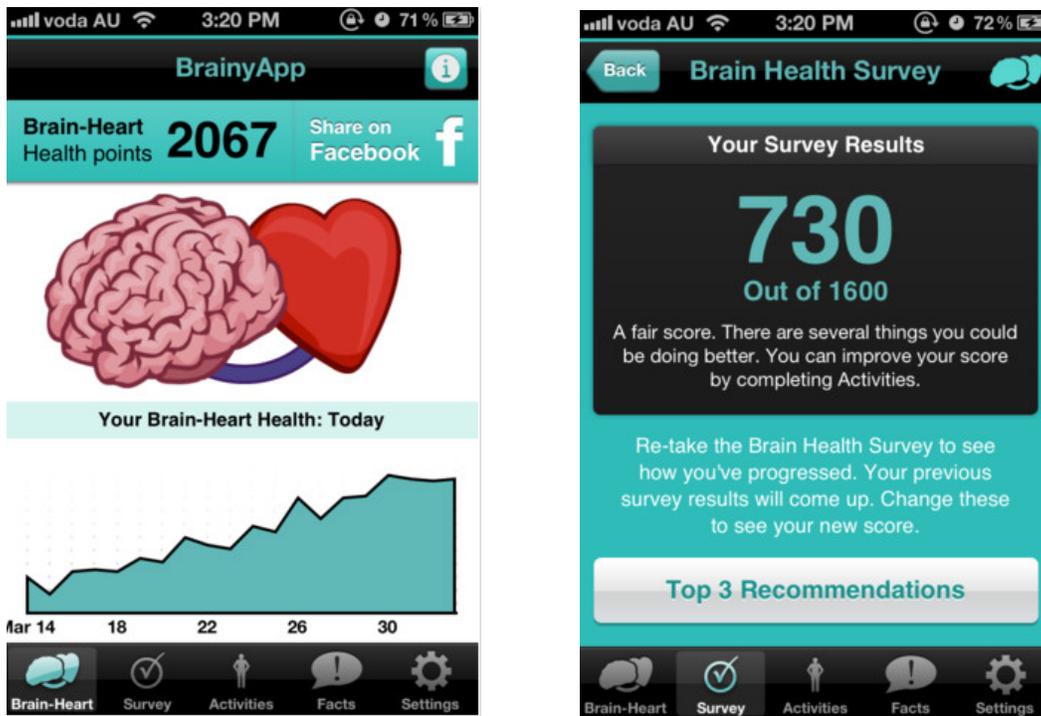


Figure 4-10. Displays screen shots of It'sDone!



Figure 4-11. Displays screen shot of What Day is It?

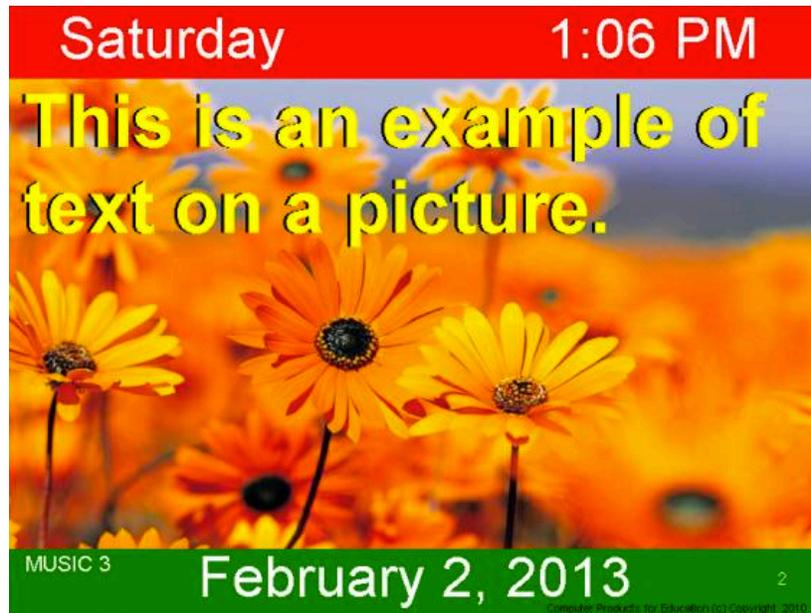


Figure 4-12a. Survey given to focus group 1 participants. (Page 1/2)

**Family Connect Survey**

**On a Scale of 1-5, 1 being the easiest, 5 being the most difficult:**

**1) How easy or difficult was it to turn on the iPad?**

Circle the answer below:  
1    2    3    4    5

**2) How easy or difficult was it to start Family Connect from the App's main menu?**

Circle the answer below:  
1    2    3    4    5

**3) How easy or difficult was it to progress through the quiz?**

Circle the answer below:  
1    2    3    4    5

**On a Scale of 1-5, 1 being the most, 5 being the least:**

**4) How rewarded did you feel after completing the application?**

Circle the answer below:  
1    2    3    4    5

**5) How dark (color) did you feel the application looked?**

Circle the answer below:  
1    2    3    4    5

**On a Scale of 1-5, 1 being easily, 5 being difficult:**

**6) Rate the ability to read the question text.**

Circle the answer below:  
1    2    3    4    5

**7) Rate the visibility of the four pictures.**

Circle the answer below:  
1    2    3    4    5

Figure 4-12b. Survey given to focus group 1 participants. (Page 2/2)

8) What color was the background color?

Circle the answer below:

White Black Green Blue Red

9) What color were the buttons and text?

Circle the answer below:

White Black Green Blue Red

**Write in Answer**

10) What could make this application easy for your eyes?

11) What could make this application more enjoyable?

12) Do you know anyone with dementia?

Circle the answer below:

Yes No

**On a Scale of 1-5, 1 being the Great 5 being the Poor:**

13) How do you feel they would do?

Circle the answer below:

1 2 3 4 5

13) Have you ever used an iPad or iPhone before?

Circle the answer below:

Yes No

13) Select the design you most preferred

Circle the answer below:

1 (Dark Blue)  
2 (Light Blue)  
3 (Light Green)

|

Figure 4-13. Shows the design style used for testing. For pictures of the full design layout see Figure 3-15. [\[Figure 3-15\]](#)

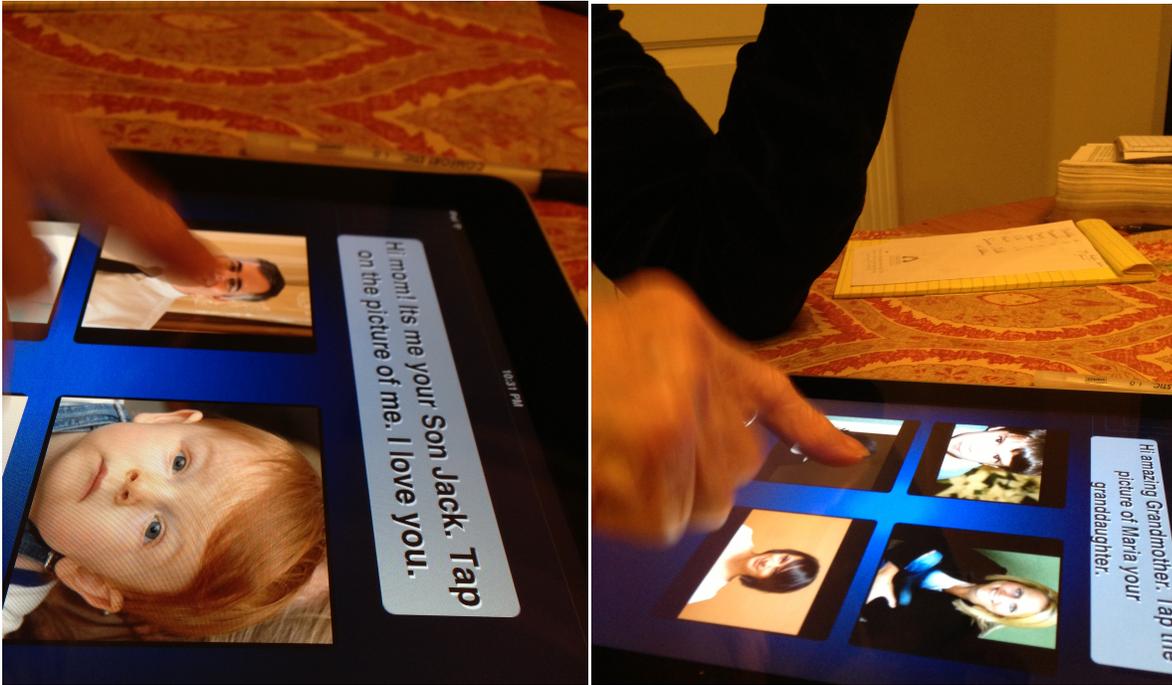


Figure 4-14. Results of focus group one.

Focus Group One Results							
Q#	Question Summary	Participant 1	Participant 2	Participant 3	Avg Ratings	Mode Ratings	Results
		Ratings	Ratings	Ratings			
1	iPad Easy?	2	3	2	2.33	2.00	Easy-Moderate to Turn on
2	FC Easy?	1	2	2	1.67	2.00	Very Easy-Easy to Open
3	Quiz Easy?	1	1	1	1.00	1.00	Very Easy-to use Quiz
4	Rewarded?	4	3	3	3.33	3.00	Moderate-No Reward
5	Color Dark?	3	3	4	3.33	3.00	Moderately Dark
6	Visibility Question	1	1	1	1.00	1.00	Very Easy to Read
7	Visibility Images	2	1	1	1.33	1.00	Easy to See
8	BG Color?	Blue	Black / Blue	Blue	Blue		BG Color was Blue
9	Button Color?	White	White	Black/White	White		Button Color was White
10	Easy to read?	Answered	Answered	Answered	Answerd		-
11	More Enjoyable?	Answered	Answered	Answered	Answered		-
12	Know anyone with AD?	Yes	No	Yes	YES		-
13	How would they do?	1	None	2	1.50		Great-Well
14	Used an iPad?	Yes	No	Yes	YES		-
15	Design you preferred?	1	1	2	1.33	1.00	Preferred Dark Blue Design

Figure 4-15a. Survey given to focus group 2 participants. (Page 1/2)

**Family Connect Survey #2**

1) Which Design Choice would you select?

Circle the answer below:  
1 Dark Blue  
2 Lite Blue  
3 Green

2) How easy or difficult was it to View the Text of Design Style #1 (Dark Blue)

Circle the answer below:  
Very Easy    Easy            Neutral    Difficult    Very Difficult  
1            2                    3            4            5

3) How would you rate the color of Design Style #1 (Dark Blue)

Circle the answer below:  
Very Appealing    Appealing    Neutral    Bland    Awful  
1                    2                    3            4            5

4) How would you rate the Layout of Design Style #1 (Dark Blue)

Circle the answer below:  
Very Appealing    Appealing    Neutral    Bland    Distracting  
1                    2                    3            4            5

5) How easy or difficult was it to View the Text of Design Style #2 (Lite Blue)

Circle the answer below:  
Very Easy    Easy            Neutral    Difficult    Very Difficult  
1            2                    3            4            5

6) How would you rate the color of Design Style #2 (Lite Blue)

Circle the answer below:  
Very Appealing    Appealing    Neutral    Bland    Awful  
1                    2                    3            4            5

Figure 4-15b. Survey given to focus group 2 participants. (2/2 pages)

8) What color was the background?

Circle the answer below:

White Black Green Blue Red

9) What color were the buttons and text?

Circle the answer below:

White Black Green Blue Red

**Write in Answer**

10) What could make this application easy for your eyes?

11) What could make this application more enjoyable?

12) Do you know anyone with dementia?

Circle the answer below:

Yes No

**On a Scale of 1-5, 1 being the Great 5 being the Poor:**

13) How do you feel they would do?

Circle the answer below:

1 2 3 4 5

13) Have you ever used an iPad or iPhone before?

Circle the answer below:

Yes No

13) Select the design you most preferred

Circle the answer below:

1 (Dark Blue)

2 (Light Blue)

3 (Light Green)

Figure 4-16. Results of focus group two.

<b>Survey #2</b>							
Q#	Question Summary	Participant 1	Participant 2	Participant 3	Participant 4	Participant 5	
		Ratings	Ratings	Ratings	Ratings	Ratings	
1	Design Choice	3	3	2	3	3	
2	Choice 1-Text?	1	1	2	1	1	
3	Choice 1-Color?	2	3	3	4	3	
4	Choice 1-Layout?	4	3	4	4	3	
5	Choice 2-Text?	3	3	1	2	5	
6	Choice 2-Color?	2	2	1	3	3	
7	Choice 2-Layout?	4	3	4	3	3	
8	Choice 3-Text?	1	2	2	1	1	
9	Choice 3-Color?	1	2	3	2	2	
10	Choice 3-Layout?	3	3	4	4	3	

Participant 6	Participant 7	Participant 8	Participant 9	Participant 10			
Ratings	Ratings	Ratings	Ratings	Ratings	Avg Ratings	Mode Ratings	Results
3	1	1	3	1	2.30	3.00	Green
1	1	1	2	1	1.20	1.00	DB: Very Easy to view text
3	2	2	3	1	2.60	3.00	DB: Neutral Color appeal
4	4	3	3	3	3.50	4.00	DB: Layout is Bland
4	2	2	5	2	2.90	2.00	LB: Easy to view text
3	3	3	4	3	2.70	3.00	LB: Neutral Color appeal
2	3	2	3	3	3.00	3.00	LB: Neutral Layout Design
1	1	1	2	2	1.40	1.00	G: Very Easy to view text
1	3	3	2	2	2.10	2.00	G: Appealing Color Design
2	3	3	2	2	2.90	3.00	G: Neutral Layout Design

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## BIOGRAPHICAL SKETCH

Mr. Difato graduated from the University of Florida with his BS in Business Marketing in 2009. In 2011 he graduate with a Masters in Business Entrepreneurship. He is currently pursuing his Masters in Digital Arts and Science.