An Age-based Study on iPhone Usability

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Abstract
I will explore the domain of the iPhone’s usability by discussing my age based pilot study on three main groups: college-level youth, middle-aged professionals, and senior citizens. Survey data and usability scenarios involving senior citizen volunteers will be analyzed in detail with regards to impressions the iPhone has on users with no computer science backgrounds who do not own the device. After revealing various facts and perspectives, I will provide some insight as to the appeal of Apple’s 2007 hit product with respect to elderly users.
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Introduction

The iPhone is an all-in-one haptic device Apple confidently believes “revolutionizes” the telephone [1]. Certainly, we can regard this product as breakthrough, considering that it contains three-axis accelerometer hardware, a smart glass screen for multiple touch inputs, and core animation technology that drives the simple yet elegant graphical user interface, all of which magically fit into a sleek and thin aluminum and glass package [2]. Apple’s visionaries behind this invention present to us an admirable multi-tasking philosophy where we can creatively organize phone contacts, schedules, and various multimedia while surfing the internet at our finger tips. The question is, who will find all these breakthroughs interesting? If it is the general audience, how great is Apple at catering to an enjoyable and productive user experience for all types of consumers?

A personal admirer of Apple products, I am particularly interested in studying how our elderly perceive the products they engineer. My pilot study aims to reveal information about the “age gap” between the younger, possibly more technologically inclined youth verses “technologically uninformed” senior citizens who may not have access to our innovations. Through my exploration, I hope to impart some useful lessons that can be used in constructing more accessible, enjoyable, and intuitive interfaces for future product designs.
The iPhone offers multi-touch capabilities for users to interact with its interface. To type into its QWERTY keyboard, to make a phone call, and to listen to music, users touch a glass touch-sensitive screen free of buttons. It provides users the ability to become in tune with their media, such as using the “two-finger pinch” to zoom into a photo, and flipping through album art with a flick of a finger. All events are triggered only by various touch inputs onto the glass screen.

Although its screen reacts to various touch strokes, it doesn’t provide feedback to signal to the user a particular graphical element was pressed. Given that the iPhone has thin and small dimensions, the keyboard size may not cater to users with large or frequently clumsy fingers. The dimensions of this phone are 11.6 mm by 115 mm by 61 mm, while the screen display real-estate covers 3.5 inches diagonally [3]. Finally, there are no customizable options where one can change the look of the user interface, let alone change font sizes if they aren’t readable.

In terms of price, the iPhone’s cost can range from 399 to 499 dollars, not including tax, depending on the amount of hard drive space [4]. On top of the initial phone purchase, monthly AT&T-only service plans ranges from 59.99 to 119.99 [4], varying in generosity of free minutes, and free nights and weekends options.

Apple’s iPhone Voluntary Product Accessibility Template (VPAT) discusses concepts such as zooming, TTY support, and visual voicemail, but mentions nothing about GUI text re-sizing customization settings [5]. It does however mention the possibility of using an “appropriate” stylus instead of a bare finger for usage.
There are two modes of cognition: experiential and reflective cognition [6]. Experiential cognition is a state of mind in which we perceive, act, and react to events around us effectively and effortlessly, whereas reflective cognition involves thinking, comparing, and decision-making. A good user interface has a learning curve that is appropriate for the product’s level of difficulty.

When digesting new systems, users construct mental models in order to effectively interact with them. A usable device that encourages a strong mental model enables someone to learn more about how it functions. In contrast, erroneous mental models form when people make assumptions based on a general valve theory of the way something works. It’s the interface’s responsibility to effectively communicate with its user in order to minimize confusion and enhance enjoyment, sensuality, and efficiency.

We can assist understanding of a good mental model with transparency, which is present when there is useful feedback in response to user input, and easy-to-understand and intuitive ways of interacting with the system [6]. A good interface is “context-sensitive”, meaning, it should cater to a level of experience, and explain how to proceed when a user is not sure what to do at a given stage of a task.

While we have these HCI ideals, unfortunately our current technology designs do not cater to the entire global community. Though there are challenges experienced when creating new devices, we should be considering the cognitive potentials of every user, regardless of dynamic physical and mental changes we all experience when we age [7][8].
Given the information with regards to cognitive modes and ideal mental models, we can derive the following questions about the iPhone’s interface:

- Does the iPhone’s haptic interface provide sufficient feedback about events to its users, aiding their adaptation to its learning curve?
- Does the iPhone afford itself (e.g. its graphical user interface is self-explanatory, and minimal to no documentation lookup is necessary)?
- Is the iPhone context-sensitive?

After investigating more about the iPhone’s user experience, I will reference these points in my concluding analyses.

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**Study Overview**

By no means did I embark in a study that claims to have statistical significance, given that I am one person investigating with limited resources and time. However, I do feel we can learn from the user experience notes I’ve collected. I will only personally study a sample size of thirty, and ten of each age group: college students, middle-aged professionals, and senior citizens.

Having only one iPhone, I determined it is physically difficult to conduct large group experiments where people perform usability scenarios for statistics gathering. To consolidate, I opted to perform a very light study in two ways: surveying and individually-based experimenting. While my survey questions will target all age groups, my scenario-based experiments will only concern residents of Country Care Homes in
Atascadero, California. In my data section, we will find that the senior citizens’ answers are more interesting than the other age groups, so I felt it would be as interesting to only experiment with them as well to narrow in on how well we cater to elderly people with our latest technology. Prior to revealing the “statistics”, we will be discussing in detail about my survey and experiment.

**My survey questions cover the following areas:**

- Current computer use background: what kinds of computer-based tasks do these candidates perform daily? What types of machines?
- How would they describe on a general level how their user experience is?
- How would they describe easy-to-use software with respect to their needs?
- Can they define multi-touch?
- Why don’t they have an iPhone?
- What’s their impression of the iPhone’s usability?
- Finally, did they think the iPhone targets all age groups?

The first three questions aim to gather an understanding of each user’s technical inclination. To know their backgrounds before determining their impression of the iPhone can be useful in evaluating their evaluation of the iPhone’s usability.

The last few questions directly concern how we understand the iPhone. The question concerning whether or not they can define multi-touch can help us to determine if the creators behind the technology are thinking on a compatible wavelength with their customers, and providing a product that affords itself accurately. By
forming a clearer understanding of the technology they are using, users can formulate a more accurate mental model. It is also interesting to know why the user sample does not own an iPhone because we can determine whether or not there is primarily a usability concern versus a preference issue. If we find that people did not purchase the iPhone primarily on preference, there may or may not be strong ethical implications; however, if there are clear usability and accessibility issues, then there is much analysis to discuss.

Additionally, I conduct a scenario-based experiment summarized as follows:

- Determine how easy it is using the phone feature of the iPhone, in terms of creating phone contacts and calling them
- Evaluate how efficient it is for senior citizens to sift through music with Apple’s signature “cover flow” method versus looking through a list of song titles

Given that the iPhone is primarily a telephone and it provides an iPod utility, I wanted to see how these seniors felt about using this device for the first time.

### Survey Statistics

#### College-Level (Ages 21-22)

Out of a sample size of ten college-level students, they all averaged about ten years or more of computer experience each, where they regularly check E-mails, type Word documents, and surf the internet. These students regularly use devices such as desktops, laptops, iPods, stereo systems, video game consoles, cell phones, and calculators.
Nearly all students when asked about their typical user experience noted that using the computer is fairly easy, and ask for help if they do have any questions. Two students revealed that they are frustrated with computationally intensive programs like movie editors that tend to freeze up or slow down computer performance. One person explicitly labeled Adobe Premiere Pro and Microsoft Office especially frustrating to use due to interface complexity and the amount of processing power they require.

To describe easy-to-use and enjoyable computer interfaces, students want simple, intuitive, aesthetically pleasing interfaces that are fast at responding with event feedback. Programs should require minimal set up and learning curve, and should have all necessary utilities at hand. One person explicitly listed off the Apple iPod and Nintendo Wii as intuitive and enjoyable products to play with.

Not all students could accurately define “multi-touch.” Multi-touch sensing is a capability where users can interact with a system with multiple touch inputs at a time, as in chording and bi-manual operations [9]. Nearly 75% of the students mentioned an ATM touch screen to be an example multi-touch interface, which is technically incorrect. Most of the students discussed the iPhone, MacBook Pro, and other technology requiring multiple fingers for interaction to describe their understanding of the word. All students were asked as to the significance of multi-touch technology, and approximately 30% noted that multi-touch capabilities eliminates the need for a stylus or mouse.

When asked as to why they do not own an iPhone, over half of the students revealed the iPhone was too expensive for them to purchase. None of them mentioned that the iPhone was too difficult to use, nor expressed total dissatisfaction with the product. In fact, they admired its design and wide range of capabilities in terms of being
a phone and many other things simultaneously. One person mentioned a preference for cellular phones with physical buttons that were easier to press and memorize the orientation of, whereas the iPhone has very little buttons due to its glass-only interface.

Regarding their impression of an iPhone’s usability based on their observations of their peers who own iPhones, and who may have allowed them to play with the device, there certainly was a variety of opinions. 30% explicitly wrote about their admiration about its aesthetic appeal, and that it looks fun and easy to use. One person described the iPhone’s interface as “a breath of fresh air” because it acts like a typical computer, rather than the typical “blocky” cell phone. Another person summarized the iPhone with one word: impressive.

Finally, 50% of the sample students said the iPhone can be appreciated by all age groups, whereas 40% of the set explained that the iPhone seems to be targeting the 18-30 demographic, typically young professionals or college students. The 40% agreed that the elder generation may not appreciate all of the iPhone’s “gadgets,” simply because they may see no need for them. To counter that impression, one person revealed that she witnessed “a group of 65-75 year old men reveling at the iPhone at [a] local bakery. One of them mentioned an actor that the others could not identify, so he pulled up his IMDB page. They also took photos of themselves.”

Middle-aged Professionals (Ages 30-late 50’s)

This sample size of ten professionals, either of the medical field or human resources section of Stanford Hospital, have used technology for about ten years. Some of them write technical documents, perform basic database queries, or simply use the computer
for their at-home use, like checking E-mail. All professionals listed that they typically use desktops, laptops, and cells phones, and occasionally use devices like personal digital assistants.

70% of the professionals said that they find it easy using the computer. In describing easy-to-use software, they argued for simple interfaces that accomplish the necessary task. A good interface has “easy to understand menus and instructions. Menus that don’t lead to other menus to get information (e.g. not too many steps).” One person noted that a well designed interface features short cuts. In summary, this group generally believed that a computer should “do what it’s supposed to do with limited amount of detail.”

None of the candidates of this group could properly define “multi-touch.” One declined to answer, meanwhile every other candidate used a basic touch screen as an example for their definition. With regards to the significance of the multi-touch capability, this group noted that it “eliminates the need for a keyboard, mouse, or stylus.”

Like the college-group, this set of people believed the iPhone was too expensive and therefore did not purchase one. Over 60% were deterred by the iPhone’s cost. One person said the iPhone is appealing, but difficult to use due to interface sizing issues, so unfortunately could not buy it. One person said that the features weren’t that necessary.

Their impressions of the iPhone were all over the map. A third appreciated the capability of the iPhone managing various multimedia. A third really enjoyed the aesthetics. Another third expressed admiration for the phone, given that it sets the bar for other smart phones in their eyes. One person explicitly expressed frustration with the iPhone in that it isn’t customizable.
Finally, this group felt pretty unanimous that the iPhone is not targeted for all age groups, and that the elderly would not adopt this device. One opinion was that “it looks like it might be too complicated for older generations.” “It’s kind of hard to understand all the features.” A good summary about the perceived usability for the elderly generation in this group's eyes is:

“It has functionality that a young person would want in music, texting, and IM, etc and also to working professionals who need to stay connected to email, the web, calendars, etc.” (Anonymous individual)

**Senior Citizens** (Ages 65-90)

Unlike the previous age groups, this group rarely uses technology. In previous years, less than half of the candidates used desktop computers, and less than a fourth worked in an environment where they constantly needed to type. Candidates over age 70 only at most used a cellular phone pre-programmed by their children to auto-make phone calls. Otherwise they expressed frustration or intimidation with respect to technology, and therefore do not use computers today.

To summarize what the group felt about easy-to-use interfaces, one person expressed the need for “senior-friendly technology.” She feels that the sizing and shape of devices need to be more visible to cater to disabled and aging people. Following up with this thought, she revealed that she “wish[es] she could use technology, because senior citizens want to be able to use the same things as younger people too.”

Another difference from the previous age groups is that they never heard of the iPhone, nor even heard of the word multi-touch! When I showed my iPhone to them, over 50% of them had to squint their eyes to read the icons and other graphical interface elements. They were also astounded by the price of the device as well.
Only 20% of the candidates of this sample were excited to be able to feel the iPhone in their hands for the first time. The remaining people were either indifferent or turned off by the unfamiliarity of this new multi-touching philosophy.

Pilot Study Data

Scenario 1: Using the phone

Making a Calling Contact

Description:
Users were asked to create a contact called “sample user.” Then enter a phone number and save that contact for later use.

A = Touched Too Hard onto Glass Screen
B = Indifferent Toward iPhone Experiment
C = Confused with what Buttons Mean
D = Frequently Mistyped with Keyboard without Any Correction

Senior Citizens

The senior citizens generally had many difficulties adapting to the “universal symbols” such as the plus icon to add a contact. Due to aging, these candidates have clumsier fingers, or are not used to touching very small keys. A senior citizen commented that she had never seen the QWERTY keyboard because she had used the typewriter in the past. Meanwhile, approximately two residents pressed too hard onto the sensitive touch screen throughout this scenario because they were not used to typing on a glass screen or any small device such as the iPhone. One resident chose not to do the iPhone experiment at all, while the task was physically impossible for another resident to do because she cannot see very well as a 93 year old resident.
### Calling that Contact

Calling with the iPhone requires just a simple tap on the phone number icon. Many of the residents had little to no difficulty performing this task.

#### Scenario 2: Looking for a song

**Looking with Cover Flow**

Searching by album cover was a first for the senior citizens. After giving about two minutes for each resident to study a cover to search for (note: each cover is accompanied by the text version of its album title), I had them begin the task. Some candidates' fingers slipped and accidentally played other songs due to

![Graph showing distribution of difficulties in finding a song with Cover Flow.]

**Description:**
Users were asked to find a common song with a cover distinct from other songs. After 2-3 minutes of memorizing what it looked like, they were assigned to play it after finding it.

- A = Touched Too Hard onto Glass Screen
- B = Indifferent Toward iPhone Experiment
- C = Confused with what Buttons Mean
- D = Couldn't Trouble Shoot
- E = Couldn't Find Cover
- F = Little/No Problems Finding Song

### Senior Citizens

![Graph showing distribution of difficulties in calling a sample user.]

**Description:**
Users were asked to call “sample user.” To do so, the user had to simply press the phone number text area of that contact entry.

- A = Touched Too Hard onto Glass Screen
- B = Indifferent Toward iPhone Experiment
- C = Confused with what Buttons Mean
- D = Successfully Made Phone Call
misunderstanding of how to stroke the sensitive screen. Some candidates couldn’t
trouble shoot and gave up on the task. There were only two people who could find the
song, the rest gave up or I had to interfere with the experiment and help them.

Looking with Word List View

The success rate of finding the same song title in the word list view fashion was much
ger higher than finding a song via cover flow. Though some residents still pressed other
song names as they were searching for the target title, very few gave up on this search
task. Residents verbally confirmed their preference for looking for something with a
simple list view versus looking at fancy album covers because it is more efficient for
them. They are familiar with reading words than identifying pictures in terms of locating
a piece of information.
The Issue

*Does the iPhone’s interface design cater to the physical aging effects, user needs, and the senior users’ crystalized understandings of much older technology? If it doesn’t, what are the ethical implications?*

Analysis

As noted in the *iPhone-HCI Summary*, my analysis of the iPhone’s design will include emphasis on the following concerns:

- Does the iPhone’s haptic interface provide sufficient feedback about events to its users, aiding their adaptation to its learning curve?
- Does the iPhone afford itself (e.g. its graphical user interface is self-explanatory, and minimal to no documentation lookup is necessary)?
- Is the iPhone context-sensitive?

Using the Software Engineering Code of Ethics (SECOE), I will discuss factors such as accessibility, learning curve, and overall user experience concerns to lay the groundwork for my evaluation.

**Haptic Screen Accessibility**

I noted the frequency of inefficient finger strokes interacting with the touch-sensitive surface. When I asked these set of users to repetitively sift through my contacts list, I hoped that the repetitive motion would assist their understanding of the sensitivity of the screen and of how they should be positioning their fingers to maximize their accuracy in
completing future tasks. One could argue that the fact that some users still could not coordinate the intensity of their touch by the end of the experiment as evidenced by no triggered events on the screen indicates a very difficult learning curve for touching the screen for disabled parties. Clearly, this is a case where the design violates 1.07, where the touch-sensitive screen is insensitive towards the needs of elderly users who have hand coordination issues due to the aging side effects. An interesting note is that Apple’s VPAT claims that the “effective use of the iPhone requires a minimal level of visual acuity, motor skills, and an ability to operate a few mechanical buttons.” The wording in this caveat can trigger misconceptions because it does not explain the minimum requirement for effective fine motor skills necessary to use the iPhone. This is a clear violation of 3.11 because VPAT provides inadequate information regarding core operation requirements. Furthermore, what level of motor skills is necessary to operate the iPhone: those of a college student and middle-aged professional, or of those that can cater best to aging seniors? If it is the former, then my proof in regards to a violation of 1.07 is further solidified.

As mentioned previously, the VPAT does in fact mention the option of using a stylus instead of a finger for inputs, which admittedly is an attempt at conforming to 1.07. However, how can we determine what an “appropriate stylus” is? What is the brand and how does it sufficiently interface with the screen to not scratch it? Where can we get one? Does Apple provide a free complementary stylus for the disabled? The document fails to answer these questions nor does Apple’s website search reveal any records on iPhone styluses! The ambiguity and lack of crucial documentation violates 2.07 and 3.10, and unfortunately places a disadvantage upon the disabled who want to
be able to use the product. Users should have the right to know alternative means of using their product they purchased if the core feature proves to be inaccessible, and operating the entire device is close to impossible. The absence of the needed information connotes either carelessness or inconsideration of document reviewers, which is bad form for business procedures.

The iPhone Experience

As evidenced by my survey statistics and scenario-based experiment results, all of my tested age groups have expressed concerns of the iPhone’s target age group. According to the many of these college students and professionals, they can appreciate the iPhone because they believe it sets the bar for smart phones in terms of its capabilities. Meanwhile, the senior citizens generally did not see a need for the iPhone because they are either content with their simple non-smart phone, or preferred a device that is stripped to the bare minimum. Given that the elderly adds up to a big segment of the general populace, the iPhone’s design should also consider their preferences [10]. After all, the SECOE mandates in 1.02 that Apple’s visionaries of the iPhone should moderate their interests with respect to the public good. Granted that as a stakeholder of this product, the software engineer has the necessary responsibility to evaluate the tradeoffs associated with a project (3.10). However, there should still be some consideration of how to best target those who work best with no complexity, in terms of the product design or utility features, like that of all-in-one devices. Perhaps modifying the iPhone such that users can customize their interface’s complexity so that
it can be stripped down to bare minimum details can best aid some user experience needs.

Unfortunately, the size of icons and fonts negatively impacted all of the elderly users when experimenting with the iPhone. These seniors at minimum needed to squint to read any of my phone contacts or song titles and the text underneath the iPhone icons to effectively navigate. If a senior user needs to use any of the icons on the interface for the first time and literally cannot read the size 6 complimentary text, how can he or she operate the device adequately? Clearly this is yet another violation against 1.07, especially if the iPhone contains no customization settings for increasing the size of any text of graphical user interface. The iPhone only offers the ability to zoom in on text from the Safari browser on in E-mail.

The eye candy of cover flow did not phase the elderly candidates. They prefer sifting through multimedia with plain, readable text. For them, it is more efficient to sift down an alphabetical list in an a longitudinal manner than to seek through album art in a lateral fashion. While Apple had marketed the iPod feature of the iPhone during MacWorld 2007 by revealing the glamour of cover flow, they still need to consider which audience will appreciate that sort of technology. Of course, this aspect of the user experience is subjective, and will not be discussed with respect to SECOE.

Finally, some of the senior citizens still felt intimidated after using the iPhone, yet two outliers enjoyed using the iPhone or could at least appreciate its aesthetics and concepts. Perhaps the managers responsible for quality assurance should have ensured thorough and adequate usability testing to help mitigate the risk of encouraging users to feel negatively about themselves because of the product (5.01). By no means
should Apple overlook these common feelings the elderly have about their technology, because it would be irresponsible on their part.

The Learning Curve: In Terms of Affordance and Context Sensitivity

Given the results from my surveys and experiments, it is safe to conclude that the college students and middle-aged professionals can more effectively adapt to the iPhone learning curve over senior citizens. One variable to consider is that sample of senior citizens hardly use technology in current times due to no need, no accessibility to a laptop or desktop in their nursing home room, nor the physical ability to use today’s devices. Therefore, they do not keep up with advancing technology and the learning curve required to operate the latest innovations.

It’s no surprise when a senior citizen cannot comprehend what a “plus icon” means because they have pre-crystallized notions about that symbol. Therefore they do not think of pressing that graphical element on the screen to create a calling contact, for example, and intentionally click irrelevant icons because of their lack of exposure to this concept. For the younger generation, we may know that the icon means to add an object in a software application context, whereas the senior citizen may not understand that because they are not familiar to navigating with advanced graphical user interfaces. They may only associate the plus symbol with mathematical operations. The iPhone’s design assumes we have used pre-existing technology with similar capabilities and concepts in order to efficiently interface with it. These pre-existing technology also have required their respective learning curves, so it will be much harder for a senior citizen without the required experience to effectively use the iPhone. If the software engineers
did not weigh the tradeoffs and haphazardly formed assumptions about their user base and these cognitive factors, then they responsible are violating section 3.10. It is obviously not “intuitive” to create a contact, therefore Apple designers need to re-think of how to make scenarios like making calls have better affordance.

Fortunately, Apple does provide a few services that aid users in operating their devices. There are online video tutorials available, assuming that an elderly user is not blind and has access to the internet to view this form of documentation [11]. A senior citizen can also schedule a free appointment at any Apple Store’s Genius Bar for any hardware support [12]. There will be in person training available for the consumer to learn more about navigating with the product. In this respect, Apple covers its bases by conforming to 1.08, which definitely works in a mutual fashion, where the company forms more intimate relationships with its customers while helping them to upgrade their user experience.

Conclusion

One concept that can be summarized in one word should be considered critical in future iPhone designs: “senior-friendly.” The user experience should not only factor in glamourous animations and fancy utilities, but rather the “basics” such as readability and sufficient audio levels. If the iPhone is regarded as a revolutionary device, then it should be designed for all to experience how greatly it can enhance our lives. Perhaps as software engineers we need to re-evaluate what we currently think “intuitive design” truly means. We need to consider more seriously the context as to which a graphical element affects its perceivers in terms of size, shape, and meaning. We need to
consider how to best aid the learning curve of all ages to cater to various cognitive potentials and experiences.

My study highlights the importance of empathy with respect to the designing process. When we observe reactions during usability studies, are we only focusing on superficial feelings like the dissatisfaction or satisfaction levels of our users? Perhaps we need to re-evaluate how we study our sample set so that we can mitigate risks of making our user base feel intimated when using the technology we want to be proud of. Additionally, software engineers need to understand all human physical conditions, for when we age, we lose our hearing, our sight, and our coordination. The higher our sensitivity towards the core needs and feelings of our users, the higher quality of the design will show. Given that we have the responsibility as engineers to innovate high quality products to upgrade the standard of living, we should consider how we can enhance today’s technology so it is more accessible, yet still provides an enjoyable and intimate user experience for both young and old, in the future.

For Future Research

Obviously, there are serious limitations to my research since I’ve only explored a few scenarios and had a mere few weeks to dissect the iPhone usability issue independently with no funding. For future exploration, perhaps obtaining a grant to purchase at least thirty iPhones, and surveying and testing these three age groups with multiple scenario-based usability testing can provide more accurate data than my pilot study. Ultimately the goal of the next exploration should help us to understand the
elderly cognitive potential as compared to younger users, and how we can form future iPhone or iPhone-like devices to cater to their disabilities.

The manner in which I tested the elderly candidates was too superficial. I only allotted approximately thirty minutes per person, and never re-visited them to see if they learned since the very first time they interacted with the device. Testing the candidates by only asking them to make contacts and sift through playlist barely scratches the surface in terms of the iPhone’s capabilities. Perhaps I chose too difficult tasks to complete to these first-time users, and intimidated them with a technology they have never heard of nor dealt with, and inadvertently negatively impacted their cognitive states. There should be more sufficient training and time when asking future candidates to engage in these usability tests.

Summary of my opinions for future improvement of this study:

• Compare the learning potential between the three age groups, thirty candidates per group to amount to a sample size of 90.
• Thoroughly understand the background of each user, and understand their current cognitive potentials before engaging them in sufficient training sessions.
• Calculate the mistake statistics per iPhone utility (e.g. determine how often people mistype using the search bar of the Safari browser verses accidentally pressing the incorrect song album cover art).
• Have users pre-load in multimedia they are very familiar with so they can effectively form their own playlists and search for songs on their own terms rather than on mine.
Bibliography

* Image taken from digitaldaily.allthingsd.com