Technology Issues Faced by Seniors

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Abstract
Technology is growing and expanding at an exponential rate, meaning that the upcoming seniors and current seniors are going to have to find ways to adapt. As a group however, it was noticed that seniors seem to have a lot of difficulty with navigating their technology in comparison to the rest of society. This paper aims to identify and describe the main issues that seniors have with technology and why seniors experience barriers to access in comparison to other age groups. An interview was performed with a member from the EnTech club in the University of Waterloo, as well as an observation session which was held in Schlegel Village. These were done in order to develop an understanding of the pre-existing issues and barriers that seniors face, while venturing further into acquiring an understanding of these issues. In the observation session, seniors had the opportunity to receive lessons and get information on how their technology operates, or how certain applications work. From this session, observations were recorded, analyzed and compared with the pre-learned knowledge in order to develop suggestions to the patterns of problems that were noticed with the seniors in Schlegel village.

Author Keywords
Nielson's, heuristics; technology; accessibility; barriers; factors; functionality.

Introduction
Amongst the observations conducted, the benefits that technology has on many senior individuals who rely on its functions and support were established. With the interview session that was conducted prior to the observation session with the seniors, where the group was introduced to EnTech member Dana, who was very knowledgable when speaking about technologies that he has used to assist seniors as well as some that he recommended to assist them. Dana was enrolled in the University of Waterloo's Biomedical Science program and was currently his third term participating with the EnTech club, which is an organization based to assist those have trouble using various softwares as well as to engage those individuals with others who have experiences with using various softwares. The group members who conducted the interview with EnTech member Dana consisted of Bryan Marek as well as Daniel Jones. While the observation session consisted of group members Michael Ioannou and Daniel Jones. Chris Barclay assisted in formulating the script for the interview session as well as giving his own insights of the relationships between seniors and technology. The interview sessions purpose was primarily to make observations from the perspective of an experienced EnTech member, while the observation session was to assess the interactions seniors had with the surrounding technology as well as what prevented them from using it effectively. Both the observation and interview sessions were granted approval by ethical standards to ensure the safety of interviewed EnTech member, Dana, as well as the seniors who were observed during the observation sessions. Throughout the observations and interviews that were conducted it was evident that that seniors with both physiological and psychological conditions had some difficulty using various softwares. Psychological disorders, also known mental or psychiatric disorders, are known as patterns of psychological symptoms that can affect an individual's overall well being and examples can include Alzheimer's, aphasia, and depression. Physiological disorders on the other hand, relates to conditions that have the ability to disrupt an individual's normal healthy functions, examples include heart disease, arthritis and paralysis (McMurtrey et al, 2010). Both classes of disorders were considered when it came to developing observations. Accompanying the benefits that were identified through the observations, possible improvements or changes that could be made to

further benefit a much wider array of individuals who suffer from various conditions were also identified, especially elders who suffer from chronic conditions. The various technologies that were observed amongst use with seniors primarily included social media softwares such as Skype, Gmail and Facebook, however other softwares such as Microsoft Word and Microsoft Excel were also observed and assessed by the group. Additionally, the correlation of movements and specific actions in response to the physical aspects of the computer systems, such as keyboards, text size, style of font and other visuals were assessed in order to help design improvements for the functionality of the systems. To assess all of these factors, Nielsen's Usability Heuristics were used, which were developed by Jakob Nielsen and Rolf Molich in 1990 (Nielsen, 1995). The word heuristic is defined as a general rule of thumb, or as something that enables an individual to learn something new for themselves. This definition in regards to technology could simply imply the general rules of thumb when learning how to use a specific software effectively or how to fully access and navigate a technological device (Nielsen, 1995). The Usability Heuristics are a general rule of thumb that various software developers should follow to ensure that the access to technology is continually increasing across all of society's populations, but more specifically with the senior population. They are known as a rule of thumb rather than guidelines because software developers are not required to use them, they are just primarily used to assess the current state of a specific program and can be used to make changes to benefit its users. By observing how these individuals who suffered from both physiological and psychological disorders would interact with various software's the group was able to form some ideas on what would benefit and assist seniors. The group was then able to identify ways that these ideas may make using various software's much more simpler for seniors reducing the complexity of large databases. This was done to ensure the reduction of many of the discrepancies faced among seniors who strive to understand the fundamental aspects of technology.

Domain Background

The target problem of the study was identifying the barriers to full accessibility to technology amongst seniors and how technology can be used to make life much easier for individuals with disabilities, more specifically elders. The whole list of Nielsen's Usability heuristics was used to assess the relationships between seniors and technology, therefore it is important to be cognizant of the meanings held with each heuristic, in order to fully understand the results and conclusions. The list of heuristics include match between the systems and the real world, consistency and standards, visibility of system status, user control and freedom, error prevention, recognition and recovery, memory, flexibility and efficiency of use, and lastly simplicity and aesthetic design. Match between the system and the real world ensures that the system speaks the user's language as well as using familiar conceptual models or metaphors (Nielsen, 1994). Consistency and standards would insist that the technology expresses the same topic the same way all throughout the interface, as well as even using colour coding uniformly (Nielsen, 1994). This heuristic was notably relevant during the observation session, due to how easily a computer system can change and become inconsistent. This made it difficult for the seniors to grasp on to simple concepts, due to the varying complexity that may have arised from the functions of the program or computer system. Visibility of system status primarily keeps the user informed on what goes on during the interface while also indicating that input to the software has been received (Nielsen, 1994). User control and freedom identifies clearly marked exits as well as ways to undo or cancel actions (Nielsen, 1994). This heuristic also showed to be relevant during observations, due to the seniors making several mistakes while they were learning how to use their technology. Methods of undoing certain actions or mistakes seemed to be unclear for seniors, which appeared to make the seniors have a lack of control over their technology. This usability heuristic also falls under the same category as visibility of system status, as many of the softwares used by seniors, such as Gmail and Microsoft Word had very small icons. This ultimately caused the seniors to have difficulty accessing the various icons and settings, thus assistance would often be needed from an EnTech member. This small icons and settings would also making it increasingly difficult if a senior had a visual or cognitive impairment causing them to forget where an icon is located or its function due to the sheer abundance and size of them. Error prevention, recognition and recovery allows softwares to prevent errors from occurring in the first place while also assisting the user with identifying and recovering from software errors (Nielsen, 1994). The pure complexity of certain software applications appears to make this heuristic essentially non-existent when it comes to seniors use with technology. The usability heuristic of memory provides the user with a list of

choices in which they are allowed to pick from those choices, while also involving direct manipulation with visual objects and choices (Nielsen, 1994). Memory would account for one of the biggest obstacles faced by seniors and also relates to many of the other heuristics discussed. Finally, flexibility and efficiency of use accounts for the use of shortcuts and allowing the user to speed up specific actions (Nielsen, 1994).

Related Work

Many studies have been conducted surrounding barriers and accessibility to technology in the senior population. Some have suggested improvements in order to increase senior's accessibility to technology, while others have simply addressed the intricacy of the issues. Firstly, a study was conducted by Callari et. al., (2012) in regards to senior use with technology and their perspectives of it. This study consisted of 20 elderly people above the age of 70 (Callari, Ciairano, & Re, 2012). Initially, a thought was that elderly mistrust technology due to the fact that they can be difficult to use in terms of physiological and cognitive processes (Callari, Ciairano, & Re, 2012). The elderly in this study were introduced to modern day technologies such as the Nintendo Wii console and the Nintendo DS handheld device (Callari, Ciairano, & Re, 2012). These devices can be used to improve the well-being and health of seniors. In the study the Nintendo DS stylus was used to practice dexterity and the Nintendo Wii with a balance board to aid physiological ability (Callari, Ciairano, & Re, 2012).

Figure 1. Above is an example of the Wii Balance Board used and a demonstration of an individual's interactions with the device.

This study in result proved that seniors may be more accepting of technology as they are gateways to improving health and well-being (Callari, Ciairano & Re, 2012). A second study conducted by Bárbara Barbosa Neves and Fausto Amaro from the University of Lisbon was done in order to analyze the senior's patterns of usage and perceptions surrounding technology such as smartphones, computers and the internet in Lisbon (Neves and Amaro, 2012). The study found that the majority of the 500 participants had used or owned a smartphone, but not a computer or the internet (Neves and Amaro, 2012). The main reason for the lack of use of a computer and the internet was due to having a low amount of education surrounding the technology (Neves and Amaro, 2012). In addition, the majority of the seniors agreed that computers and the internet is essential for the development of their country and most participants agreed that everyone should know how to use a computer (Neves and Amaro, 2012). Therefore, the main issues or barriers that were identified in this study was due to a lack of technological literacy or education surrounding smartphone, computer and internet usage (Neves and Amaro, 2012). The study encouraged providing better education to seniors on how to use these types of technology in order to overcome any accessibility or functionality issues and to adapt to new technology in a more efficient manner (Neves and Amaro, 2012). The solution provided by this study were unique compared to the rest, but it is nonetheless an excellent idea that would address the root problems that seniors face with technology. However, simply providing education may not account for any psychological disorders a senior may face.

Interview Method

The data we collected was primarily on technological advancements that could be made to help assist seniors, as well as the technologies that already exist to benefit the populations of seniors. A consent form was supplied to Dana , the EnTech member who was being interviewed, to ensure that the interview met the ethical standards for the interview, and ensured the safety of the data given from Dana. Dana began the interview by providing specifics on his experiences with EnTech. Data on Nielsen's Usability heuristics was also noted when Dana was asked to point out which usability issues he noticed were abundant and ones that he believed needed to be improved among the senior population. The data was collected by simply writing Dana's responses to each question in a notebook, where side notes and extra questions to the responses would have been written down. Using the pencil and notebook, the group was able to make rough notes that were not possible to do

so quickly with items such as a laptop, and voice recording was not permitted due to consent form outlines and proper ethical practices. From these questions the group was also able to assess the softwares used by EnTech and identify the problems that were not mentioned by Dana, such as the idea of a hand stabilizer for those individuals who suffer from Parkinson's or other motor control diseases. The observations were then edited, eliminating the information that did not have great significance to the study, as well as adding the group's own insight to the responses as mentioned above, resulting in the creation of the group's own hypothesis on what difficulties seniors experience with technology prior to conducting the observation session.

Interview Results

Through the interview with Dana the group was able to identify that seniors who have medical conditions of either physiological or psychological disorders, were the main individuals who required assistance. The group also identified that EnTech is able to do research on a specific condition to find out further ways to benefit software users who face deficits. Dana also mentioned that EnTech is always open to new ideas that have the potential to reduce the obstacles faced among seniors, and that technology is constantly advancing to the point where it has the potential to reduce deficits faced amongst seniors. However, Dana mentioned that he did not directly apply to EnTech because previously to joining he knew very little about the program. The co-founder of EnTech had known Dana and he proceeded to ask him if he was interested in assisting seniors with technology. Dana also stated that he hadn't volunteered for a long period of time, only being with EnTech for three terms plus being a member of the Campus Response Team, leaving him little time to participate with seniors, and that he would have to volunteer with EnTech for a much longer period of time to identify all of the issues and benefits associated with technology and seniors. This lack of experience with the club from this particular individual may have limited our pre-analysis of the issues that seniors face with technology. Throughout his experiences though, he noticed that every individual requires a different set of attention, some of which have severe difficulty using technology while others are very intelligent and have the ability to navigate their way through complex databases and softwares with ease. He also mentioned that there is an increasing amount of individuals who are using using technology, and as a result becoming more accustomed to it.

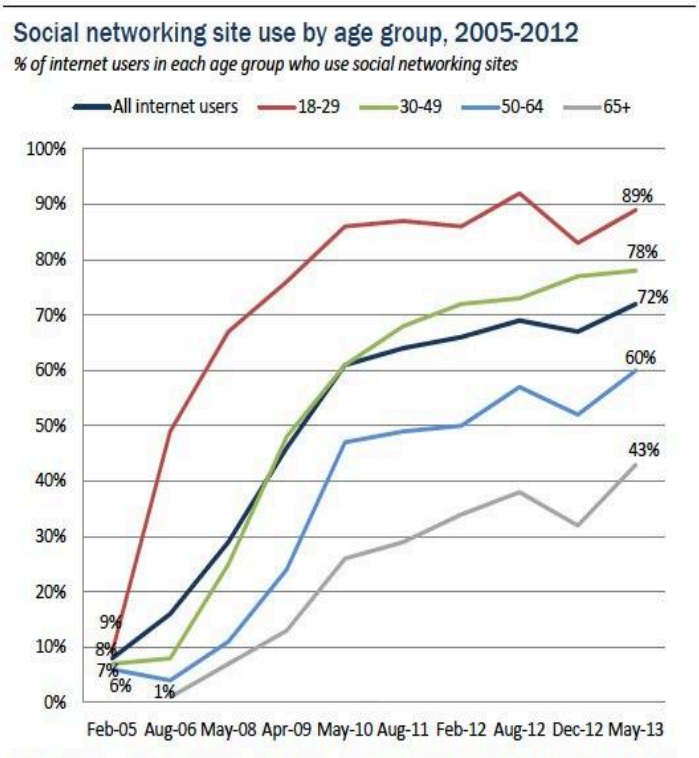

Figure 2. The graph displayed above represents the increasing use of social media with elders over the last few years.

To benefit those who have difficulty using the various softwares he showed the group some methods that have proven effective in assisting seniors, some of which included short cuts in complex softwares for those individuals who had poor memory and thus had difficulty navigating their way through the system, proper reminders set up when the resident was using a specific software to keep reminding them to do specific tasks, and using short sentences and simple words to assist those who had speech impairments affecting their ability to understand the speaker. An example that he noticed among some users was cognitive impairments that affected their ability to control their actions, such as Parkinson's disease, making it difficult for them to interact with touch screen devices and the smaller size of keyboards. Also recalling a similar patient who had extremely poor vision and was unable to identify small wording as well as images, and even the lettering on keyboards. With some manipulation of softwares, their complexity could be reduced to assist those who had trouble identifying various icons, as well as enlarging them to assist individuals who have visual impairments. Also implementing a larger keyboard

with large lettering and even adding a texture to the various keyboards, such as braille which is a tactile way of identifying letters and numbers to those who are visually impaired. This would ultimately allow the operation of various technologies to become much easier for those who suffer from such disorders. Lastly, Dana mentioned that touch screen devices, such as smartphones and tablets, were very interactive and that many of the individuals whom he assisted at EnTech were using them and they can be some of the easier technologies that seniors can use due to their ability to easily manipulate and change settings to desired ones that better suits the user's needs, such as language and font size options. Accompanying this, voice recorders and cameras were also easy to master due to their simplicity and effectiveness amongst seniors.

Observations

The data that was collected was based on how a sample of seniors interacted with their technology. A technology-help session was held in a long-term care home named Schlegel Village with the help of four members from the EnTech club. The EnTech club was there in order to help seniors improve their functionality and accessibility with their technology products, while teaching them how to use basic computer or smart phone applications. Observations were made based on a sample size of two seniors and notes were made via smartphones. Factors such as hand movements, coordination, tapping (for iPad or smart phone users) and vision were the primary focuses for the observations. These observations were further used to develop and discover certain barriers to access that the seniors had with their technology and how to improve functionality with the products.

Observation Results The observations that were noted were found to be consistent between the two seniors that participated in the help session. The first senior that came into for help was named Phil. It was previously stated by one of the EnTech members in the session that Phil seemed to have a good grasp of the general concepts surrounding technology and generally knew how to key navigation and functionality features.

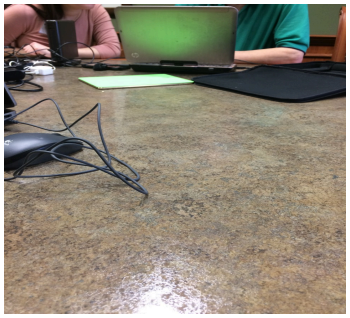

Figure 3. Phil receiving assistance with his laptop from one of the EnTech members.

The senior thoroughly demonstrated this remark, as he was able to navigate through his laptop and smartphone with relative ease and proved to thoroughly understand the core functions of each product. He came into the session wanting to understand how to access specific features on his devices, such as how to unmute contacts on his phone or how to check the amount of storage left on his laptop. Phil was able to learn and understand these concepts with a low amount of difficulty, however his issues with technology seemed to arise with the tactile and visual aspects of his devices.

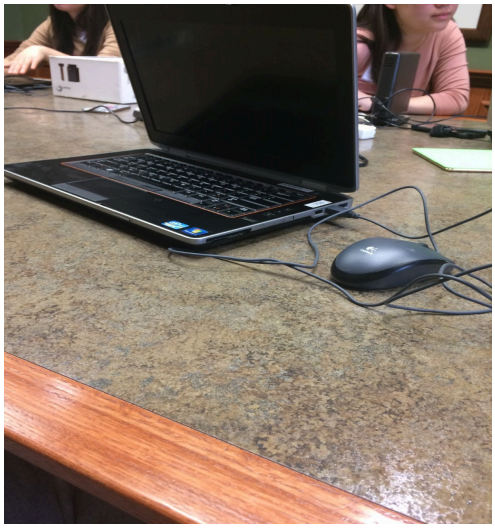

Figure 4. One of the computers used by the EnTech members in order to help the seniors.

Firstly, Phil was suffering from Parkinson's disease, which made it difficult for him at times to use the keyboard on his laptop or on his smartphone. The more prominent barrier to full accessibility that Phil was experiencing however was due to the fact that the letters and icons on the keyboards and screens of his devices were too small for him. This required

him to lean in extremely closely to his keyboards and screens in order to properly navigate his devices. From the observations noted, it was seen that this barrier could become aggravating for senior technology users, which is why it was noted as a major observation. The second senior that was observed was named Richard. Richard only owned a tablet device and only wanted to understand the basics of the Skype application. From watching Richard being taught how to properly use the application, it was evident that the senior was experiencing an immense amount of difficulty when it came to tactility. Richard couldn't press the keys on his tablet properly, therefore it required multiple tries in order to input one letter at a time. Richard also had to look closely at his keyboard and at the icons on screen, similar to Phil. Despite learning the general concepts regarding the application however, Richard seemed to have forgotten the steps required to fully use the app, so the EnTech member had to write out steps for him. This observation led to the conclusion that some seniors may have difficulty in regards to memory and memorizing the steps needed to navigate their technological devices. From what was observed and gathered from this session, the domain problem seems to mainly be concerned with tactility and vision. Among both seniors that were observed, seeing items on screen or letters on the keyboard required an unnecessary amount of effort in order to reach efficient navigation and full functionality, which ultimately hindered the user's accessibility to the technology as a whole. Adding an increased amount of pressure on the aspect of vision appeared to inadvertently decrease the user's memory, as seen in Richard's case as well. Tactility was also an aspect that connects with the domain problem, as both seniors had difficulty at times when it came to typing on keyboards. Seeing these issues visually made a huge impact on how they were interpreted. Without the aspect of visualization, the issues that were perceived may have potentially been inaccurate, unrepresentative or simply invalid. Having an actual, visual sample in order to come to conclusions and generalizing patterns allows for the entire scope of the domain issue to be recognized and interpreted in an accurate manner. In terms of the observation process itself, creating detailed notes and considering the smallest of issues that the seniors were experiencing had proved to be greatly beneficial when it came to understanding the domain problem and was an overall strength to the main approach used to gather the observations. However, there was a main weakness to the approach used that may have obscured or made the observations less accurate. The amount of questions that were directed towards the EnTech members and the seniors themselves was drastically low, which may have caused a decrease in information to be obtained about the issue. This method of observing was done in order to provide authenticity to the observations and to minimize interference that may have arised while the seniors were using their technology.

Discussion and Future Work

The main strength of the EnTech interview was the insight provided by Dana. He painted a visual as he explained his work with seniors in regards to technology. As students who have not conducted field work with seniors, the interview provided a better understanding of the problems that seniors face along with the accommodations which are made in order to better assist them. The EnTech member shared that seniors utilize different features such as speech recognition in order to have a better experience with technology. Similarly, he mentioned that some seniors prefer to use phones and iPads as opposed to computers because they are more direct than using a mouse and physical keyboard. Also, another strength was being able to connect course concepts such as Nielsen's Usability Heuristics to Dana's experience. This provided a good first step in applying concepts learned in Health 173 to the real world. Furthermore, this interview was significant because Dana provided information from his personal perspective which is unique to other members' experiences. He shared how seniors are actually quite intelligent with technology and enjoy it. Additionally, it was interesting to be introduced to which applications seniors used such as Snapchat, Facebook and Skype as opposed to just using email. The weakness of the EnTech interview was that Dana was not quite up to date with EnTech. As he is busy with school and working with the Campus Response Team, he had not been attending sessions at Schlegel village recently. This may have had an effect on his understanding and explanations in comparison to an EnTech member who consistently and has recently attended meetings. This provided some limitations. Moreover, another weakness of the interview was simply the fact that is was only verbal communication. There is a large difference between being told information and physically seeing. The experience of actually going to Schlegel village for observations was much more potent than asking questions. Being able to physically go into the field of EnTech work was a large strength of this project because the main goal is to observe how the elderly interact with technology. Witnessing seniors such as Phil and Richard brings a greater

meaning than simply being told about seniors using phones and computers. This ties into the strengths of the observation session; physically seeing from a first person perspective how seniors use their devices and adapt to modern day technologies. Another strength is looking in depth at what seniors are interested in doing with the power of technology. For instance, Richard wanted to use technology to call his friend on Skype, and Phil wanted to transfer data from his laptop to an external hard drive and edit videos. A weakness of this experience was that we only had a chance to observe for a limited amount of time. Further observations may have opened up different conclusions and more data to be compiled. Also, only two seniors were able to be observed, more seniors would provide extra data depending on what they wanted to do with technology. The main weakness of the observation session was the time restriction and low amount of seniors to observe. The session lasted two hours, however the seniors only joined part way through the session, therefore leaving us with less data be compiled than a full length session with them. There were numerous things learned throughout the interview and observation sessions. For example, it was not known that seniors would be so well adept in modern day social applications such as Snapchat. One would think that seniors would only be interested in possibly emailing, but realistically they enjoy Facebook, Snapchat, Instagram, Skype and are open to learning about new applications. Another interesting point learned from the observation session was their knowledge of storage. Phil was able to use terms such as ‘gigabyte's’ to describe the amount of space left on this laptop. This went in hand with him actually using up all of the space on his computer surprisingly and needing to use an external hard drive. If more time was provided for the project, it would be interesting to observe more seniors. Observing more seniors would provide a more well-rounded perspective on how seniors act with technology. It would also be beneficial to interview a few EnTech members to get their perspectives of work with EnTech as each person will have different stories of their work.

Figure 5. Keyboards often presented seniors with difficulty due to the small key size, and lettering. Keyboards such as the one above allow seniors to identify the keys easily as well as proper input of letters and numbers without the chance of pressing other keys by accident.

Moving forward, there is room for quite a few improvements that could be done to adjust a senior’s experience with technology. A customized keyboard with larger font size could be used for those with poor vision, so they do not have to move closer to the keys. This would not only improve the overall relationship and functionality between the user and the system, but would redesign for ergonomics and reduce the amount of physical strain required to operate the system by the senior. A stabilization device would be a great addition for those with Parkinson’s disease such as Phil. A stabilizing stylus for example could be used with a tablet or phone to more accurately type on their smaller keyboards. This type of technology would not only help with individuals who suffer from motor-impairing disorders, but could also be used as a general product in order to improve tactile actions. As seen in Richard for example, a stylus or a stabilizing device could be helpful, as it would decrease the amount of difficulty required to tap each individual key. Continuing with stabilization, making sure that the sensitivity on touchscreen keyboards would also ensure that seniors are able to accurately input letters and words as they wish. Since touchscreen keyboards appear to be either too sensitive or not sensitive enough, finding the middle group for this factor would increase accessibility to a variety of functions on a touchscreen computer system and would therefore be further optimized for senior users.

Conclusion

In conclusion, working with EnTech and conducting observations was a momentous experience. It was a good bridge for applying concepts examined in class to the real world which the majority of first year courses do not do. Creating interview questions

allowed for deeper thinking about what the EnTech members do and how they help seniors. The interview session was extremely significant because any initial thoughts or inquiries could be answered by the member. Followed by this was the observation session where information from Health 173 and the interview both tie in together to give a better understanding of the seniors and how they interact with technology. The takeaway from this project is that seniors can become as well verse in technology as anyone in this current generation.

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