Role of Technology in
Reducing Social Isolation Amongst Seniors

by

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Abstract

The purpose of this major research project is to understand what seniors' social situation as they age and the effects of social isolation can have on them, and how information communication technologies (ICT) can be a means to reduce social isolation. Through an inclusive research method of participatory action research and co-design, three participants aged 65 years and older were selected to use Facebook Messenger, a popular social application for a period of three weeks. During this time, participants assessed if such an application is easy to use and access. Participants' experience demonstrates that social applications such as Facebook Messenger are not designed taking into consideration requirements of the aging population. For social applications to be inclusive, the researcher proposes that design teams should be diverse to identify and understand various user group requirements.

Keywords: social isolation, aging, information communication technologies, social applications

Acknowledgment

Dedication

My loving grandfather, S. Natarajan

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1 Personal Introduction

As a researcher and designer, I think it is important to include my personal experience with technology and what I observed of the digital gap in accessing and using technology. It is important to acknowledge the position the researcher brings to the research and the perspective that inevitably influences and enriches the observations. It emphasises the purpose of the research and makes it relatable as each one of us at some point in time would have struggled using technology or noticed someone struggling with it.

I developed a deep interest in designing technology for the aging population during my Masters in Inclusive Design at OCAD University. I moved from India to pursue this specific area of study in Toronto, Canada, as a way of delving deeper into the study of user experience design. It was a cumbersome move and impacted me in several ways, especially in being apart from family and in a new culture. The lifestyle in Canada is significantly different to India, in part because everyone has the opportunity, regardless of age, to be independent.

My generation, often referred to as the millennial generation, has grown up with rapidly developing technology and it is now an integral part of our daily lives. I began using the computer when I was in grade four to make presentations on Microsoft Powerpoint. My first

exposure to the Internet and social media was around the same time in the form of MSN Messenger, a direct messaging application for friends and family to keep in touch with each other through chatting.

Today, there are countless social media platforms such as Facebook, Twitter, Instagram, and Skype that people use on a daily basis to communicate with each other, across the globe. In fact, social media usage has grown rapidly from 970,000 users in 2010 and is expected increase to 2.44 billion by 2018. (Guzman, 2016)

As millennials, we use social media to communicate with each other, for entertainment, for work and for studies. Due to this, these platforms have changed the way we do business and the way we function as a society more broadly, which is evident in new and popular services like Uber and Airbnb. Technology has influenced my generation to the extent that it is even a key component of relationships, as noted by a Pew Research Center. (Lenhart & Duggan, 2015).

The Pew Research Center is a non-partisan American research organization that does not take policy positions and has a mission to inform the public. While such data is beneficial in understanding public's preferences and behaviour, it is important to note that the information that is represented has been categorised according to

demographics, and often such statistics might not include individuals' specific preferences as it is generalized. Hence, it leads to assuming a specific age group has the same experience and preference. That said, Pew helps identifying if such generalized data is relatable at an individual level, and if not, how the experiences and expectations of the user group differ.

In 2016, Pew released a report indicating that 6 in 10 Americans receive news through social media. When getting news through social media, people are often able to see who recommended the article and are able to communicate with that person directly, shifting the experience of being informed to being social and conversational as well. (Gottfried & Shearer, 2016)

While the majority of millennials use social media, this cannot be said for people over 65 years old. Between 2005-2015, PEW identified that young adults aged 18 to 29 are more likely to use social media compared to seniors aged 65 years and older, and up to 90% of them do. (Perrin, 2015) Though not as dramatically engaged, seniors are joining the digital world as is indicated in their adoption of social media. Only 2% of seniors were using social media in 2005, compared to 35% today. The adoption levels for seniors to social media has

increased but there is still a significant gap in usage compared to 18-29 year olds. (Perrin, 2015)

It is clear that social media has become influential on our society today, creating opportunities for connection that have never been possible before. It has provided us one more method to engage with people and, if used effectively, it can give people greater access to various products and services as well. Unfortunately, most of the world's websites and applications are targeted and designed for millennials, disadvantaging individuals who are 65 years and older. I believe this is one of the reasons why the adoption rate of seniors is so much lower than my generation's, as they find it difficult to use the very platforms that could bring value to their lives. Seniors should be able to use the Internet – from online learning and social networking to cat memes - with the same ease as younger generations.

There were times when my late grandfather in India asked me to help him use his iPhone. Things that I considered simple, he struggled with. For example, adding a new person to his contact list, forwarding a message or even saving a photo proved to be challenging. Each involved interactions between the device and him that were not designed in an intuitive way, or provided him the necessary feedback to learn. I saw that this was a common situation

many of my friends also experienced with their grandparents and older relatives.

As a student in Canada who was missing home, it was particularly frustrating to know that the technology was capable of facilitating a more meaningful relationship between my grandfather and me despite the distance between us, but it didn't.

In an effort to understand this problem better, I opted to participate in an elective course at University of Toronto called "Human-Computer Interaction (HCI) and Knowledge Media Design (KMD) For Seniors with Mild Cognitive Challenges". As part of the course, students were responsible for testing a social application specifically designed for seniors experiencing Mild Cognitive Impairments. Each week for four months, I met with a participant to provide support in learning the application. While the application was a simplified form of many social media platforms we use, and despite my presence as her "iPad teacher", my participant struggled to use it and often felt frustrated with herself. Her experience of feeling frustration was not isolated.

Ultimately, for a senior, the user experience of the application was poor and did not meet her needs. This reframed my experience with my grandfather and his iPhone. The problem was not that my

grandfather was not able to learn how to interact with his iPhone, but rather the iPhone applications were not designed to meet a 70-year-old man's unique needs.

As Don Norman, author of the Design of Everyday Things, has vocalized countless times; if different users are consistently making the same 'mistakes', it's a good indication that it's a bad design. (2013) This indicates that the users were not able to understand the functionality of the design, which is the fault of the designer and not the user.

Inclusive designers attempt to circumvent such design failures by recognizing diversity early in the design process, so as to serve the diverse needs of different users. A major component of creating an inclusive design includes implementing inclusive processes and methodology.

User experience designers for social applications continue to emphasize the millennial user, an indication that there will continue to be a gap in use amongst seniors. This is a tremendous opportunity loss, not only for corporate revenues, but for a rich and vibrant society as well.

1.1 Goals for this Project

This design project intends to investigate the user experience of one social media platform, Facebook Messenger, when used by people aged 65 years and older. The objective is to understand when seniors encounter challenges and how the interactions can be improved to create ease of engagement. The research follows an inclusive design methodology where participants of the study are co-creators in improving the user experience to meet their needs.

The intention of the project is to ideate possible improvements to the user experience of Facebook Messenger for the aging population. Through this process, the paper will highlight the unequal and taxing experience of seniors using Information Communication Technologies (ICTs) compared to younger generations. This paper also hopes to understand if ICTs can be valuable for seniors, how seniors can be engaged in the process of improving their experience with ICTs, and gain insights of what changes could assist in bridging the digital divide between seniors and millennials, specifically in the application Facebook Messenger.

1.2 Inclusive Design Dimensions

For this design project, I focused on Inclusive Design principles that allow the integration of marginalized users/participants into the research process.

The Inclusive Design Research Centre, based in Toronto, Ontario, is where an international community of advocates, designers, and developers study and contribute inclusive design methodologies to tangible projects. Inclusive Design is "design that considers the full range of human diversity with respect to ability, language, culture, gender, age and other forms of human difference." (Treviranus, 2014)

Inclusive Design facilitates design for a marginalized or disenfranchised population, specifically by valuing the user as a designer. It shifts the design approach from one-size fits all towards one-size-fits one, which often involves the ability for a design to change in order to meet diverse user needs.

Inclusive design applies an expanded form of user-centric design. The IDRC describes that there are three dimensions to Inclusive Design, which I believe are worthy of consideration in approaching a design project focused on people over the age of 65.

1.2.1 Recognize Diversity and Uniqueness

Inclusive design keeps the diversity and uniqueness of each individual in mind. As individuals spread out from the hypothetical average, the needs of individuals that are outliers, or at the margins, become ever more diverse. Most individuals stray from the average in some facet of their needs or goals. This means that a mass solution does not work well… This does not imply a separate, specialized or segregated solution. Segregated solutions are not sustainable economically or technically. Inclusively designed personalization and flexible configurations must be integrated to maintain interoperability and currency. This also does not imply adaptive systems that make choices for the user. Inclusive design recognizes the importance of self-determination and self-knowledge. (Treviranus, 2014)

In relation to my grandfather, it is easy for me to acknowledge how unique he was. As a career lawyer, he was an intellect and a compassionate community member who often offered his services free of charge. He had a strong personality that, if infiltrated, would give to silly jokes with puns and wordplay.

As he was aging, it became difficult for him to learn by himself and he needed more support from the family. He began to lose attention in things quicker, which could have been related to the challenges associated with hearing loss and visual impairments. He had access to technology, like his iPhone, but a complete discomfort in using it.

Inclusive design recognizes each of these details not as problems that must be solved with additional features, but rather as attributes of a user that must be taken into consideration.

1.2.2 Inclusive Process and Tools

> Inclusive design teams should be as diverse as possible…
> To support diverse participation and enable the design to be as closely linked as possible to the application, the design and development tools should become as accessible and usable as possible. (Treviranus, 2014)

While I have learned a great deal from practice and the theoretical study of design, there is no doubt to me that a user's experience is the most important contribution to a design project. Inclusive design suggests that this is pushed to a greater extent and means empowering an individual like my grandfather to become part of the design team.

I have no doubt that if approached, my grandfather's reaction would be that of inability, the belief that he is not a designer by trade and has no expertise. It is essential that designers disrupt this attitude and reduce barriers for such users to engage in the design process, such as by meeting one-on-one as opposed to in a focus group or travelling to the user as opposed to forcing the user to travel to the design team.

1.2.3 Broader Beneficial Impact

It is the responsibility of inclusive designers to be aware of the context and broader impact of any design and strive to effect a beneficial impact beyond the intended beneficiary of the design. Inclusive design should trigger a virtuous cycle of inclusion, leverage the "curb-cut effect", and recognize the interconnectedness of users and systems. To realize this broader positive impact requires the integration of inclusive design into design in general. (Treviranus, 2014)

I believe it's not only important to recognize the potential beneficial impact of inclusive design, but that co-designers also understand it as well. The externalities of inclusive design are significant to the "typical" user's experience as well. While my grandfather's engagement in the design process for an application on his iPhone may result in an optional simplified layout, another user may utilize the same feature to teach a child how to use the application. The "curb-cut effect" described by the IDRC refers to how sidewalks that were redesigned for wheelchair access also benefited abled users:

On July 26, 1990, President George H.W. Bush signed the landmark Americans with Disabilities Act, which prohibits disability-based discrimination and mandated changes to the built environment, including curb cuts. "Let the shameful wall of exclusion finally come tumbling down," he proclaimed. Then a magnificent and unexpected thing happened. When the wall of exclusion came down, everybody benefited—not only people in wheelchairs.

Parents pushing strollers headed straight for curb cuts. So did workers pushing heavy carts, business travelers wheeling luggage, even runners and skateboarders. A study of pedestrian behavior at a Sarasota, Fla., shopping mall revealed that nine out of 10 "unencumbered pedestrians" go out of their way to use a curb cut. (Blackwell, 2017)

Inclusive design dimensions are not a fool proof way of making a product accessible for each and every person, despite their unique needs. Rather, by understanding these inclusive design dimensions, researchers have a framework on which to reflect upon while engaging marginalized and disenfranchised individuals in the design process.

2 Background

This design project explores how Information Communication Technologies (ICTs), specifically social media platforms, can be improved to reduce social isolation experienced by the aging population. It is common for seniors to feel excluded from society as they age due to the transitions in their lives, such as retirement, relocation, shifting social networks due to illness and dealth, and physical and/or cognitive changes. These transitions make it difficult to stay socially connected. Through this MRP, I explore a popular communication application created by Facebook called Facebook Messenger, and assess if such an application is easy, intuitive and accessible for seniors to maintain connection with friends and family.

Seniors have a wealth of knowledge, skills and experiences; their lived experience is valuable and, in some cultures, seniors play a significant role in supporting younger generations. Nevertheless, with the rise of new technologies, there has also been a societal shift to disregard the experiences and skills of seniors and to view them as dependent. "For some, becoming old feels like being thrown on the trash heap; with their children grown and focused on their own families, and retirement from the job that had defined them, they feel useless and unwanted." (Pitlane Magazine, n.d.)

But it does not need to be that way. Seniors provide "the social and cultural continuity that holds our communities together" (Pitlane Magazine, n.d.) they have a role to play in society and society is improved when valuing their contribution. Seniors are and will continue to be a core pillar of our societal makeup and the family unit, especially as modern medicine has continued to make strides and increase life expectancy. Seniors are also a significant economic body, contributing greatly to Canada's economy in 2016, while also holding substantial wealth and paying taxes. (Menec, 2012)

Seniors are also a significant contributor to the social welfare of communities. In 2000, "seniors in Canada contributed an astounding 179 million hours to volunteer agencies, an amount of time that is not

only beneficial socially, but economically as well. According to Statistics Canada, in 1998, 42% of Canadians aged 55-64 and 44 percent of Canadians over 65 spent an average of 2.2 hours a day as volunteers. The economic value to our communities is thought to be $60.2 billion each year." (CARP, 2010)

For seniors to continue to be contributors of our society, it is essential that they are able to age successfully. Successful aging has many definitions based on the discipline of study. Bowling and Dieppe (2005) describe that biomedical models describe it as the "absence of disease and good physical and mental functioning" while sociopsychology models put emphasis on "life satisfaction, social functioning and participation..." Another way to measure successful aging shifts focus from evaluation of behavior to how a senior perceives their present and past. If they are happy and satisfied with their life, then they are said to be aging successfully (Williams et al. 2008). This perception of successful aging suits my research as it focuses on the well-being of the senior and not on the decline or illness they are experiencing; it has a broader understanding of well-being compared to other definitions, which often focus on the negative effects of natural aging.

2.1 Aging Population

Individuals who are 65 and older are considered seniors and fall under the "old age" group in Canada (Community Development Halton, 2016). With a large concentration of baby boomers, Canada's aged population is growing rapidly. A Statistics Canada (2015) report describes that one in every six Canadians are seniors, representing about 5.7 million of Canada's population. The Canadian Broadcasting Company (2015) states that Canada's population of people aged 65 and older is now greater than the population of children under the age of fifteen. The process of going from middle age to senior, also known as the process of aging, is particularly important in regards to standard of living. During the process of growing old, otherwise referred to as aging (Community Development Halton, 2016), seniors go through multiple transitions in their life. These transitions can be physical and/or social and are often consequential of each other, such as losing a partner and having to move into a new community due to financial restraints (Nimrod, 2009). While seniors are experiencing these transitions, it can have a grave effect on their well-being. Studies noted an increase in mortality rates when seniors are relocated to nursing homes, indicating that a low social engagement level was a significant variable in predicting mortality (Hjaltadóttir, Ingibjörg, Ekwall & Nyber, 2011).

2.2 Social Isolation and Loneliness

A report by National Seniors Council of Canada (2014) identified that social isolation is a significant issue experienced by seniors in Canada. Although there are limited statistics on the exact number of seniors experiencing social isolation, there are many reports that describe the impacts of social isolation on seniors' health and well-being. Social isolation can be described as a "result of the elderly population's reduced social interactions—particularly with family, friends, and community networks—caused by their retirement, physical changes (cognitive and physical disabilities), inevitable loss of spouse or friends (shrinking network size), and/or living alone or in institutions." (Chen & Schulz, 2016)

Seniors who experience social isolation are frequently experiencing changes in their life that affect their well-being. If a senior feels socially isolated, they are unable to contribute to society or age successfully. When seniors are unable to contribute, they often feel a lack of meaning in their life. Meaning is said to be inseparable from belonging according to social psychologist Tyler Stillman (2015) of Southern Utah University, whose "…studies have shown that when people are excluded or when they experience loneliness, they feel life has less meaning. On the other hand… When life is filled with positive and enduring relationships, life is filled with meaning. Perceiving

meaning, mission, and purpose tends to bring more happiness, more hope, positive outlook, and a generally better sense of well-being… This dynamic package in turn attracts still more fulfilling interactions. People who feel their life has purpose are people with whom others want to forge social bonds" (Scott, 2015).Therefore, it is important that seniors have meaning and purpose, and that they are able to successfully contribute to society, specifically in relation to the ability to age successfully.

I personally have learnt about my culture and religion from my grandparents. During summer vacations, I would spend time with them learning about religious rituals and listening to their stories of being young, raising my parents, including their struggles and fond memories. In India, seniors are heads of the family and often looked up to for advice on a range of issues. (The Huffington Post, 2015) Similarly, Elders in Aboriginal communities are seen as keepers of knowledge and tradition. They are said to hold important lessons in their hearts that they choose to share with other members of the community to make it a better place. (Elderly Voices, 2015) Seniors have a great deal of knowledge, skills, and experiences that can be shared with younger generations. It is important we have healthy seniors who aging successfully so that they are able to share their wisdom with us.

2.3 Senior Neglect and Information Poverty

The digital divide refers to the unequal access to the Internet and Information Technology. Since the beginning of computers, there have always been groups that have had better access compared to others, such as the rich having more access than the poor, young people using internet more than seniors, developed countries having better infrastructure than developing countries. (McMurtrey, McGaughey, & Downey, 2008) There are various reasons why the divide exists and can be due to technological, political, social, and cultural reasons. (McMurtrey, McGaughey, & Downey, 2008) Pew analyzed the digital divide in America in 2016 and identified that seniors were the lowest users in home broadband, mobile usage and owning a smartphone (Raine, 2016).
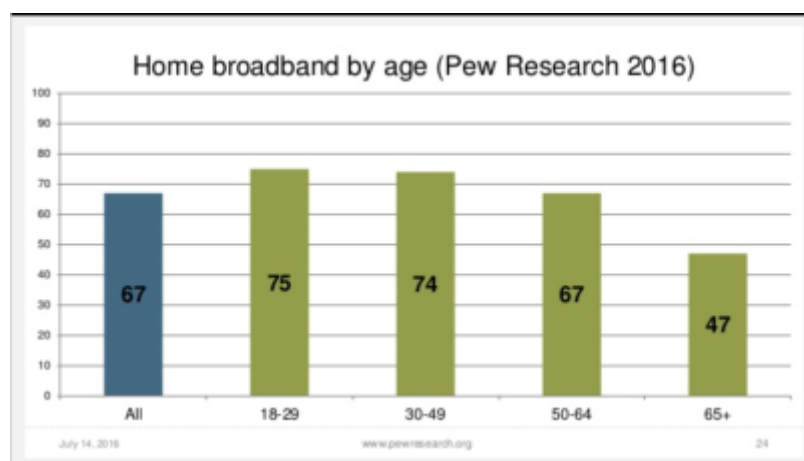
Figure 1: Home broadband by age
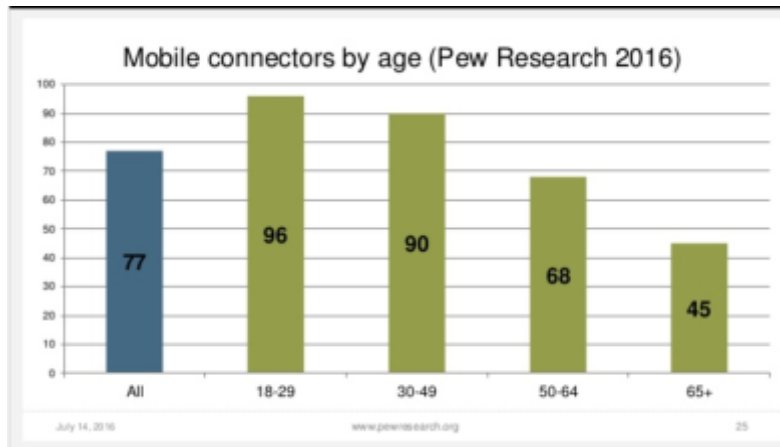
Figure 2: Mobile connectors by age
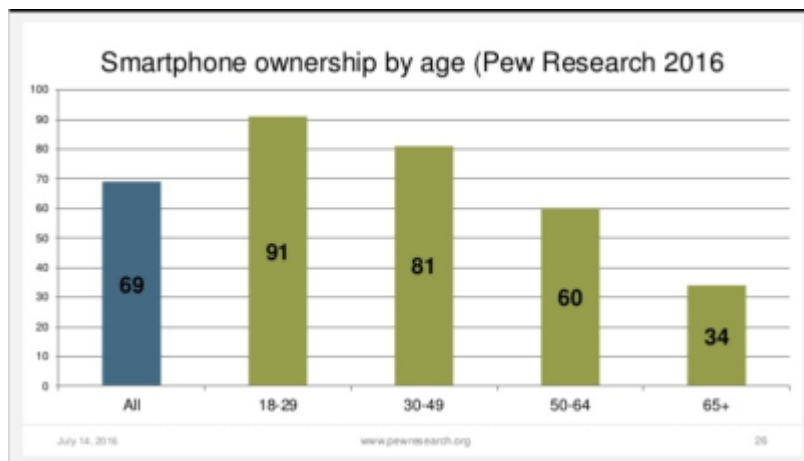
Figure 3: Smartphone ownership by age

The research statistics highlight the age related digital divide that exists in America. The majority of IT companies target younger users, making it more difficult for seniors to use their products and services. Jacob Nielson (2013) of the Nielson Normal Group researched seniors' experience online and identified that 45% of seniors were hesitant to try something new and 90% of them blamed themselves

instead of the application for not being able to complete a task. (Nielson, 2013) It is evident that seniors find it hard to use the Internet and technologies with the same ease as younger generations. "We live in a society where information and knowledge is power. Hence those without internet access are increasingly being recognized as the "information poor" (Morris, 2007). Seniors would be considered information poor as there are barriers in access and interaction with the Internet and technologies. Those who have increased access to internet and technology will be considered information wealthy, such as the younger generations, who tend to have more access to information and communication technologies.

3 Exploring Social Isolation and Loneliness

Many studies have analyzed the effects of social isolation and loneliness on the well-being of seniors. There are many interpretations of what social isolation is and how it is related to loneliness. Various researchers are unable to define the concept of loneliness and social isolation and use the terms interchangeably (Wenger et al. 2004, Chen and Schulz 2016). The way the terms are interpreted directly affect the framing of the problem and how the research is conducted with participants. For this reason, I have analyzed some of the existing literature regarding defining these terms.

3.1 Defining Social Isolation

Frequency of contact is often connected to loneliness, which is greatest amongst middle-aged adults, though "for some individuals, the perception of social resources is entirely unrelated to the actual amount of time spent alone." (Cornwell and Waite, 2009) The issue of perception is extremely important through the aging process, as 75-85 year olds have higher levels of perceived social isolation than 57-65 year olds. (Chen and Schulz, 2016) According to Wenger et al. (2004), social isolation "is defined as a more objective concept, based on the absence of contact with other people, an absence that can be quantified…"

Often, social isolation is described as "the opposite of good social support," (Cotton et al., 2012, Wenger et al., 20014) which is problematic from a defining standpoint. These concepts are associated with different disciplinary approaches to research, which leads to "psychological research focusing on subjective aspects of isolation and sociological research emphasizing social integration. As a result, the relative contributions of subjective aspects of isolation, such as loneliness and perceived support, are rarely considered alongside social disconnectedness and social inactivity" (Cornwell and Waite 2009).

While it is not particularly clear how social isolation and loneliness differ in their definitions, the methods in which they are measured are indicative of a senior's experience and well-being. There have been many indicators that scholars have used to identify social isolation and/or loneliness, such as social disconnectedness and perceived isolation, terms that are often interchanged. Cornwell and Waite (2009) prove that social disconnectedness and perceived isolation are not interchangeable and have distinct relations with physical and mental health. Chen and Schulz' (2016) research suggests that there are two definitions of social isolation; where there is "absence of contact with people who provide social support", and where social isolation is perceived as a two-dimensional concept of an "objective absence of contacts or interactions with the contacts and a subjective feeling of limited or lost companionship or social support (i.e. loneliness) resulting from having limited contacts or interactions." (Chen and Schulz 2016)

It is understandable why some scholars use terms loneliness and social isolation interchangeably, as loneliness often focuses on the feeling of lack of contact. Wenger et al. (2004) describe loneliness as a "subjective measure of unwelcome feelings or perceptions on the part of the respondent, associated with a lack of contact with others or with a particular other, as a result, for example, of bereavement or

geographical separation. It is associated with an unsatisfactory level of communication and closeness with others." The lack of communication and closeness can be situational and some scholars have identified situations where someone is at risk of experiencing loneliness, which often relates to older adults. Such situations include relocation to a retirement home or care giving facility, having a new caretaker, chronic illness, death of social ties, limitations in physical and mental health, and living alone. (Cotten et al. 2012)

Wenger et al. (2004) measured loneliness through the following subjective indicators: how often does the participant feel lonely, how often does the participant see and interact with people, how confident does the participant feel, and does the participant wish they had more friends. It focused on the participant's perception of loneliness and the results can be subjective. Having fewer friends and meeting less frequently does not directly imply that someone is socially isolated or feels lonely. This is supported by Cornwell and Waite's findings that - "loneliness is weakly correlated to social network size and frequency of interaction with network members." (2009)

Studies of perceived isolation characterizes it as "subjective experience of a shortfall in one's social resources such as companionship and support. Feelings of loneliness and not belonging,

for example, indicate a perceived inadequacy of the intimacy or companionship of one's interpersonal relationships compared to the relationships that one would like to have." (Cornwell and Waite, 2009) This is similar to what Cotten et al. (2012) stated in their research, "loneliness is a subjective experience of negative feelings about levels of social contact; otherwise stated, it is the involuntary state of social isolation, that is, the feeling of being alone. Loneliness does not stem solely from objective levels of contact, but rather results from the differences between the levels of need and desire for social relationships and the availability of relationships at hand."

For some individuals "the perception of social resources is entirely unrelated to the actual amount of time spent alone," (Cornwell and Waite, 2009) which complicates using frequency of contact as a measurable aspect of social isolation. Then again, an individual's perception of their social resources might not reflect the actual situation of how connected and engaged they are with their network (Cornwell and Waite, 2009), as perception and actuality do not have to agree. This further supports the requirement to develop a better method to identify social isolation. Having seniors/participants define what they consider social isolation and loneliness would help develop a set of indicators that are appropriate to the group with whom the research is conducted. Another interesting finding is from Toepoel

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(2013), who states that older people have less social contacts and take part in less social activities but are more satisfied with their social contact than younger adults/generations.

I agree wholeheartedly with Chen and Schulz (2016) who suggest that social isolation is multi-dimensional and "largely understudied." There are certainly factors that are common to social isolation and loneliness, such as living alone, relocation, physical and mental health, widowhood and death of social ties. (Wenger et al., 2004)

Understanding that social isolation can be perceived in many ways, and that it can be confused with loneliness, for this study, we define it as the absence of contact and the absence of meaningful social relationships and/or experiences that provide good support (Cotten et al., 2012). This definition is valuable as it does not use the term loneliness, nor does it put the onus on the individual, indicating that social support – or the environmental conditions – play a role. Furthermore, to qualify for social isolation under this term, both contact and meaningful relationships are taken into consideration, leaving room to identify an individual who does not have frequent contact but meaningful relationships as socially connected. This definition respects an individual's ability to define and interpret what

social isolation means them, which resonates with inclusive design methods of recognizing individual uniqueness and diversity.

3.2 Effects of social isolation

Social isolation can have effects on a person's physical and mental health, and the effects are greater for the aging population (Chen and Schulz, 2016). It can negatively contribute to senior's life and cause increased rates of morbidity and mortality, depression, and self-harm- drug abuse, and alcoholism. (Cornwell and Waite 2009, Chen and Schulz 2016) These effects are severe, create an unnecessary burden and can lead to further disconnection from society. As seniors age, they become closer to people who remain in their network regardless of the network size and frequency of interaction. Additionally, they adjust their expectations and perceive high levels of support from their network. Therefore, senior's perception of their social network might not reflect how socially isolated or disconnected they actually are. (Cornwell & Waite, 2009) Being socially disconnected is associated with worsening of physical health regardless of feelings of loneliness and perceived lack of social support (Cornwell and Waite 2009), which indicates that it is a public health issue that requires attention.

Seniors who are socially isolated can experience reduced social skills. Due to physical and mental health deterioration, seniors can feel uncomfortable around other people, making them unable to participate and contribute to their communities. As seniors continue to be socially isolated, they are exposed to possible risks of being unaware of information, services and programs available in the community. In this case, a vicious cycle can be created whereby socially isolated seniors lose social skills and thus, become less able to access the very resources needed to keep them socially connected. Social isolation can also impact a senior's self-esteem and confidence, making it more difficult to integrate into society. (The National Seniors Council, 2016)

3.3 Supports for Social integration

3.3.1 Social Support

Research has demonstrated that social isolation and loneliness are often related to negative effects of wellbeing, while social support that can be provided in multiple forms has been related to positive health outcomes. (Tomaka et al. 2006) Each senior is unique and has different set of requirements that help them integrate into society, and make them feel socially connected and supported.

Being socially connected, which is not dictated just by frequency of engagement, is valuable for seniors and for society at large. Social

supports can help bring about this value and these supports can come in various forms such as instrumental, emotional and informational. (Tomaka et al. 2006, Cornwell and Waite 2009, Strine et al. 2007)

Instrumental support refers to physical, financial and information assistance, in other words the kind of support that helps in solving a problem or answering a question. (Tomaka et al. 2006) Individuals who receive instrumental support from their network of family and friends, and co-residents help them with coping methods that reduce stress. (Cornwell and Waite 2009) The availability of resources and guidance provide support that can relieve and avoid stress. For example, if a senior wants to buy a new phone but does not know how to drive, having a network member who can drive them to the store and help with the purchase makes the experience less stressful.

Emotional support pertains to the feeling of belonging to a group or feeling cared for by a group or a person. (Tomaka et al., 2006) Strine et al. (2007) adds to this definition as, superficially relating to having a "space one can share their problems and vent emotions. For example, if a senior is experiencing pain due to their arthritis, having a family member check-in with them and ask them how they are feeling and provide encouragement will be valuable

support to overcome their difficulty. Furthermore, having a private room in which family can discuss such challenges is also important. Emotional support boosts an individual's self-confidence and self-esteem. (Strine, Chapman, Balluz, & Mokdad, 2008)

Informational support helps individuals, seniors in this example, make more informed decisions (Strine et al., 2007) and provides access to information and material resources. (Cornwell and Waite, 2009) For example, if an aging individual wants to open a saving plan as they do not have sufficient funds for retirement, having a family member or close friend guiding them about their financial options will serve extremely useful and help the senior make an informed decision. This gives the individual more knowledge and a sense of control, which contribute positively to their experience.

The other forms of categorizing social support are through the type of connection with network members: partner/spouse, family, friends, co-residents. (Tomaka et al., 2006) It is evident that social support is a crucial aspect for successful aging, given that older adults are experiencing so many transitions in their lives. Having someone to talk to, someone to ask a favor or simply go for a walk with has positive effects on older adults' health and well-being. (Jolanki and Vilkko, 2015)

An importance consideration is that not all individuals require the same support, which is why categorizing types of support is a valuable mechanism to connect the right support to the right senior. Additionally, digital technology has the potential to play a role in providing social support to seniors.

4 Role of Technology in Reducing Social Isolation

4.1 Opportunities

4.1.1 Internet

While evidence of the positive effects of communication and socialization later in life are plentiful, especially preventing cognitive decline, there are some important cultural shifts that are important to take into consideration. McKinsey and Company (2014) describes how the Internet now plays a central role in modern life, as it has "grown from a nascent technology to a tool that is transforming how people, businesses, and governments communicate and engage." The Internet is not only central to modern life, but it is a driving force in the process of modernization. This is not only true at an individual and microeconomic level, but at a macroeconomic level as well because, in recent years, the Internet has now contributed to economic growth more than energy and agriculture. (Said et al., 2011)

The Internet is a tool and much like the common hammer, it can be used to build beautiful structures or to destroy them. Katz and Rice (2002) eloquently describe this, "the Internet is not a utopia, liberating people to form a global egalitarian community, nor a dystopia, producing armies of disembodied, lonely individuals. Like any form of communication, it is as helpful or harmful as those who use it." Still, they do acknowledge that most Americans who engage in Internet usage do so as "an extension and enhancement of their daily routines."

When Castells (2014) considered the impact of the Internet on society, he found that "virtual life is becoming more social than the physical life, but it is less a virtual reality than a real virtuality, facilitating real-life work and urban living." The Internet can be and often is a tool to create community, to reconstruct social relationships on the basis of individual interests and values. (Castells, 2014)

For individuals who are isolated, the Internet can help connect one with their need for socialization. For elderly, the Internet can be a vital component to providing socialization needed to prevent the risk of experiencing social isolation as well. However, the growth of the Internet has not served to be advantageous to all segments of the population. While the Internet has made products and services

available to a wider and remote population and has changed the way that the information wealthy operate on a daily basis, the same cannot be said for Canadian seniors. Not only are seniors the largest offline group in Canada but of those who use the Internet, only 52% access information related to healthcare, which is an area of information beneficial for seniors to be accessing.

4.2 Constraints

4.2.1 Low Connectivity

According to Statistics Canada (2016), 98% of all homes in the top income quartile had internet access in 2012. The Internet is not equally distributed between the wealthy and the poor, as only 58% of homes in the lowest quartile had Internet access. In considering the intensity of Internet usage, there were some insights regarding the exclusivity of the World Wide Web, as "senior intensive users came from households with similar median income levels and had similar levels of educational attainment to other online seniors (nearly 30% in each group had a university degree)." (Statistics Canada, 2016) The exclusivity does not stop at income and education, but flows into gender as well, with a study showing that "just over one-half of senior men who used the Internet from home were intensive users,

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compared with fewer senior women online (53% versus 39%)." (Statistics Canada, 2016)

It is important that the Internet is made accessible as 7% of seniors describe their reasons for not using the internet as difficulty of access. (Statistics Canada, 2016) These disparities are problematic when we know that the Internet can have such a dramatic impact on socialization, and ultimately the well-being of an individual, as we age.

It is important to ask why is the internet is not accessible for the aging population. It is clear that internet access is one barrier that is highly dependent on income and economic status. Another component is well described by Paul and Stegbauer (2005):

> "The problem of non–access and exclusion has been for long time on the agenda of Internet research, mainly looking at the consequences of a presumed knowledge gap. Social inequality in most concepts is strongly linked to Internet access: income, education, parents social status and other traditional predictors of social differences loose their weight; what counts is information and Internet access in a world in which information is the most important resource (which creates the digital divide between the information rich and poor…)."

Not having access to internet or not having the ability to interact and consume information through the internet leads to seniors becoming information poor. The consequences of being information poor in today's time is severe. I am 26 years old and have used ICT as

a part of my daily life for over fifteen years. I created my first power-point presentation when I was in grade four. I wrote multiple assignments on the computer and stored it online. If my house burned down tomorrow, I would have lost few belongings but the important documents will be available online; giving me the luxury to restart and relocate with ease. This would not be the case for many seniors.

70% of the people who died in Hurricane Katrina in the United States in 2005 were over 60 years old. Those who survived could not receive medical care as all the paper health records were destroyed by the storm. (Roberts, 2014) Similarly, in New York, during Hurricane Sandy, thousands of people used social media for safety updates. Numerous seniors did not use such methods and could not seek help or information with the same ease. (Roberts, 2014)

Emergency situations are just one example that communicates the importance of internet access. During extreme conditions, having seniors connect online would enable them to engage with their communities instead of being inactive bystanders, or victims.

4.2.2 Low usability

Unfortunately, the digital divide is partly caused by the fact that seniors are unable to use the internet with the ease that other generations tend to use it.

There is some evidence for a linear decrease of Internet use in all age groups. If non–users are the main problem, then the elderly become a significant problem group… We have to keep in mind that the IT sector targets its products to the young and affluent … Product developers do not care very much about the fact that the elderly cannot use tiny mobile telephones very well or that they are unable to decipher icons… Our own research showed that producers of electronic devices widely neglect the needs of the elderly, whom they regard as a marginal group. (Paul and Stegbauer, 2005)

Although research in ergonomics on user–friendliness has a sound set of rules and standards, producers do not think of a "design for all" when developing new applications and programs. The same is true for many Internet sites. The personal computer itself is too complex and only the very enthusiastic are willing to care about new upgrades, read incomprehensible instructions and buy specialised magazines offering tips and tricks. As Donald Norman noted:

The major problem with today's PC is its complexity. The complexity of the PC is pretty fundamental; it is built into its foundation. There are three major reasons for complexity: the attempt to make a single device too many things, the need to have a single machine suffice for every person in the world and the business model of the computer industry. (2013)

Our devices and websites are complicated for a non-user to adapt to it with ease. The idea that one device can have multiple functions is difficult for seniors to comprehend. If these devices and platforms are designed in a simpler form, seniors would have more

opportunities to communicate with families, be up to date about news and have more access to services. If seniors continue to be neglected from the Internet, the digital divide will continue to grow. This acts as a barrier and prevents successful aging in the 21st century, making it more difficult to achieve the goal of a society with a vibrant contribution from an elderly population, which will soon be a huge percentage of Canadian society.

5 The Design Project

This design project aims to engage an inclusive design methodology with seniors to practice a design process that actively engages these marginalized users. Specifically, this design project will focus on the use of the application Facebook Messenger as an exemplar, and attempt to identify potential user experience design improvements that would allow for a more meaningful experience for seniors.

5.1 Inclusive Processes

5.1.1 Co-design

Co-design is a process where the researcher/designer and participant together design. This is specifically important in the process of inclusive design and meeting the needs of a marginalized population, in this case seniors. While designers have the required skillset to design an application, seniors have the lived experience of the application being difficult to use. Often in research and design, participants are consulted with to gather their feedback about a design. In my design project, I focus not only on collecting participant's feedback but also in engaging them in co-design to improve the user experience. Co-design shifts the dynamics from

researcher and participant to all members involved the project to be co-creators of the design and solution.

5.1.2 Rapid prototyping

The process of rapid prototyping further supports the inclusive design framework where we make participants "active agents" of the solution process. Often in research, participants are included to test an idea and provide their feedback. Participants are seen as a step in the process, a method to validate design decisions, and they are not usually seen as co-creators or given the opportunity to contribute and brainstorm with product teams. The inclusive design framework believes that participants are experts in the field of research they are requested to take part in. In this case, seniors living independently while experiencing multiple transitions in their lives know about the constraints of using Facebook and Facebook Messenger because they have experienced it. The framework states that:

> Inclusive design teams should be as diverse as possible and include individuals who have a lived experience of the "extreme users" (as coined by Rich Donovan) the designs are intended for. This also respects the edict "nothing about us without us" without relegating people with disabilities to the role of subjects of research or token participants in design exercises. (Treviranus, 2014)

Co-creation is made possible by adapting the role of participants from subjects of research to active agents of the design process.

5.2 Research Questions

This design project aims to answer the following questions:

1. What user experience barriers do seniors face in using Facebook Messenger?

2. What components of user experience create disconnection when using Facebook Messenger?

3. What interface elements should be considered to improve a senior's use of Facebook Messenger?

5.3 Process

The design project aimed to involve a group of six participants, seniors aged 65 years and older, preferably living in a retirement home with Wi-Fi connection in Toronto, Ontario. Seniors living alone or in a retirement home were considered ideal participants for design project, considering their experience of recent transitions and likelihood of experiencing elements of social isolation. Another requirement for the study was access to Wi-Fi. When participants are using Facebook Messenger on the iPad, they would require internet access. The research aimed to have a mixed group of participants (male and female) who were capable of making informed decisions for themselves. This design project did not desire to include seniors

experiencing cognitive disabilities, an area where additional research would certainly be valuable.

Participants for the research were recruited from retirement homes in Toronto, Ontario. A research participation was sent via email to retirement homes in Toronto.

As this design project was a graduate level study that had a short duration to conduct research, I ran into several challenges. Some of the challenges were related to retirement home restrictions that did not allow for such studies. As I was not affiliated with any research or senior care organization, it posed as a hurdle to gain access to well-established retirement home organizations in the Greater Toronto Area. Another challenge was due to the duration and tight timeline of the research. Some interested retirement homes had other research projects and activities happening during the intended period of study. The other challenge in recruiting participants for the research was skepticism from potential participants about the design project. Some seniors were skeptical to join a design project that involved technology and the Internet. Other seniors comfortable with using technology and internet were not comfortable using social media and having an online identity. Also, there were some seniors who were interested in taking

part but did not have internet access which posed a barrier in taking part in the research.

Ultimately, three participants were selected for the research through the help of the Inclusive Design Community and Toronto Intergenerational Partnership organization. Participants selected for the design project did not have any prior relationship with me.

Participants were briefed about the research in person or via phone, which included talking about the process and time required to participate. Participation in the study was completely voluntary and participants were informed that they can choose to leave the study at any time. I then provided the information consent forms to participants and they were given sufficient time to go through it and were encouraged to ask questions. Once the participant was comfortable with the research and process, I proceeded to the next step, which was the first meeting with the participant.

5.3.1 METHOD A: Meeting sessions with participants

Participation in this study was on a one on one basis between the participant and researcher. Seniors tend to feel intimidated when learning something new, especially if it is to with technology. (Nielson, 2013) For that reason, no focus groups were conducted for this study. This method of research applied the second dimension of inclusive

design, inclusive design processes and toolkits. The meeting structure supported the one-size-fits-one approach by accommodating each participant's preferences of meeting time, duration and location.

Out of the three participants, two lived in low income retirement homes in the East-end of Toronto, Ontario and one participant lived independently in a condominium in the West-end Toronto, Ontario. I met with the participants at a time and location of their convenience. One participant preferred meeting at their home, while the other two participants preferred meeting at the computer room in their building.

5.3.1.1 First Meeting: Contextual Understanding

The intention of the first meeting was to learn more about the participant and their preferences, and discuss what they thought about living independently, support and technology. The meeting had an informal tone and often included participants sharing memories and family moments. To help guide me during the first meeting, a list of questions was used. Some of the questions were:

- Tell me a bit about yourself
- How do you identify yourself and communicate that identity?
- Has your life changed in the last few years? If so how?
- What do you feel about living by yourself?
- What do you feel about companionship and support?

These questions provided valuable insights about how the participants perceived themselves and their environment. Are they seeking support from others and, if so, what kind of support are they seeking? It also helped me evaluate the usefulness of ICT for seniors.

The second part of the meeting consisted of a set of tasks aimed at introducing the participant to Facebook and Facebook Messenger if they did not have a Facebook account. If participants had a Facebook account, they were introduced to how Messenger behaves differently on the desktop/laptop vs iPad and mobile. Participants were also provided the following items that they would use during the duration of the design project:

- An iPad mini that had Facebook Messenger application installed
- A diary for participants to document their experience when using the application and device.
- A list of tasks the participant could try and perform in the application. This was provided to help participants in exploring the application and a method to identify areas they found difficult to grasp. Tasks such as the following were included:
  - Send a text message to one of your friends
  - Take a picture using the application
  - Forward a message from a friend to another friend

If participants were new to Facebook Messenger, they were asked if they wanted to add any family members to Facebook Messenger and, if so, the participant was encouraged to send a message to family members about the study to encourage communication with this platform.

5.3.1.2 Second Meeting: Co-design and prototyping

After gaining an understanding about the participant and their preferences and abilities, the second session focused on co-creating the experience on Facebook Messenger. Participants were asked the following questions to learn about their experience and where the application could improve its interactions to better meet their needs:

- Overall experience of the participant in using Facebook Messenger for one week
- What did they like/dislike about the social application?
- What they like changed or added to the social application?

As the participant communicated their experience of using Facebook Messenger, I made note of any experience that was frustrating or that the participant could not understand. When the participant communicated frustration while completing some of the tasks, I reframed the task as a prototyping activity for ten minutes using the iPad, sketch book and pen as tools. I asked the participant

about the elements on the screen that they found frustrating or confusing. Based on the response, I quickly sketched out a few possibilities to improve Facebook Messenger's interaction. Participants were then asked to provide feedback and suggestions. I asked open-ended questions regarding the element and how the design could be improved. Using such collaborative approach, the participant and I together explored solutions to the problem that the participant was experiencing. After a short discussion, the task flow was resumed.

5.3.1.3 Third Meeting: Co-design and wrap up

The third meeting with the participant was the last meeting between the research and participant. The participant and I discussed the participant's overall feedback about Facebook Messenger and their experience in the study. Some questions asked were:

- After participating in the study, would the participant prefer using ICT to communicate and keep in touch with family members?

- What do they feel about social isolation and the role of ICT to reduce it?

- Would they like a one-page summary of the findings from the research?

I finally thanked the participant for their time and informed them that they can contact me with any questions related to the study.

5.3.2 METHOD B: Self-guided journals

Self-guided journaling method was used to document the participant's experience in using Facebook Messenger. The participant was provided a book to document their experience with Facebook Messenger, with some prompts. The journal entries were completely voluntary and participants were encouraged to document a minimum of three journal entries per week, of their favorable or frustrating moments while using Facebook Messenger. These entries helped me to identify areas to improve the interaction for the participant. The journal was collected at the end of the third meeting along with the device.

5.4 Confidentiality and Anonymity

5.4.1 Confidentiality

During the study, the following identifiers were collected from the participants:

- Participant's name
- Participant's contact information

- Participant's address

- Audio recordings of sessions with participants

- Journal entries

Documents containing personal identifiers were secured in a lock-protected file-folder. Digital files, including audio files, were stored in a password protected folder on an external hard drive. Journal entries were made in a booklet that the participant was holding until the completion of data collection. Upon completion of data collection, journal entries and audio recordings were transcribed without including personal identifiers. All personal identifiers are marked for deletion at the end of the study.

5.4.2 Anonymity

Participation in this study was on an anonymous basis. Participants will be referred to by numerical identifiers.

5.5 Participants

The design project consisted of a small group of three participants. All the participants were female and each participant had their own unique reason to take part in this research. Participant One viewed this as a learning opportunity to familiarize herself with using mobile devices and begin using Facebook. Participant two and three were comfortable with using Facebook and a smartphone. They were

excited to take part in a design project and viewed it as an opportunity to test an iPad.

I met with the participants once a week for a duration of three weeks. Meeting time and location was according to the preference of the participants. Each meeting lasted between half an hour to an hour and half.

All the participants were glad they took part in the design project and look forward to receiving a summary of the insights gathered.

6 Insights

As the design project consisted of a small group, insights from this research will be used to identify further areas that need to be researched and tested to improve the experience of the aging population's experience with ICTs, specifically Facebook Messenger. The participant group consisted of "edge users" or users that are not the primary target group designers consider through the development process. The insights gathered in this design project will be valuable in ideating possible improvements that would benefit all users.

6.1 Commonalities

From my meetings and sessions with the participants, I observed some commonalities in pain points that they experienced when using Facebook Messenger on the iPad. Each participant had varied levels of experience with devices such as laptops and smartphones, as well as in using Facebook and Facebook Messenger. Despite that, each participant of the study experienced some similar struggles in using the application successfully.

It did not take long before the first challenge arose for each participant, as it was in the signing in process. While accessing Facebook Messenger on the iPad provided for the study, each participant was unable to identify the correct password on their first attempt. For two of the participants, they had separate passwords for Facebook and their emails and it took some trial and error to identify the appropriate password. The other participant had the same password for their email but had multiple email identifications, so it took some time to recollect which email ID to use. She noted that she usually has passwords saved on her devices and they do not require her to key in such details. Facebook Messenger does not have an option to view the password, causing for more errors.

Secondly, each participant experienced issues with using a touch device. While two of the participants owned a smartphone, they were still careful when using the iPad as the slightest touch would trigger an unintended action. There were many accidental taps during our sessions which would leave the participant feeling frustrated or annoyed. When the participants were typing in their email addresses and passwords, they needed to input both alphabetic characters and numbers. This interaction required the participants to toggle between two keyboards using a specific key. Attempts to switch keyboards would often result in accidently typing an extra letter. Another instance where touch sensitivity triggered an unintended action was when participants accidently tapped the audio icon. This triggered a recording and the participant did not know how to cancel or turn off the recording.

Thirdly, each participant had difficulty understanding the different icons that were used in Facebook Messenger. Each interactive element in Facebook Messenger is represented in a form on an icon. Participants could not identify majority of the icons except for camera and text.
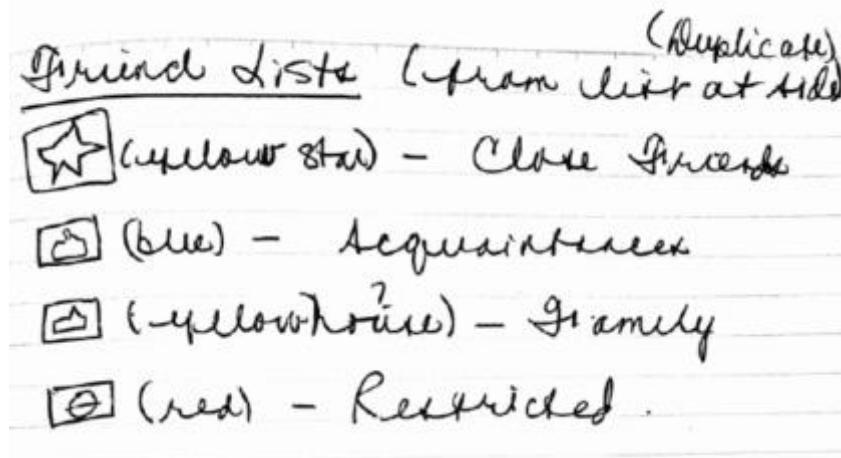
Figure 4: Journal entry of participant 1

The visuals used in these icons were not relatable to the participants. In the case of Participant One, she created a visual guide as the study progressed (see Figure 4)

The fourth issue that all participants struggled with was distinguishing using Facebook and Facebook Messenger in different devices. When trying to share a photo, participants were confused why the iPad did not have access to photos that were available on their laptops or smartphones. It took each participant sometime to understand that if they are wanting to share a photo from an album on their computer, then they will have to log on to Facebook from that device and share it from there.

Lastly, participants consistently found notifications confusing. Often, participants could not deduce what the unread messages

number was indicating. One participant's best guess was that the unread messages number indicated the number of times they had accessed Facebook Messenger's different features. Another thought it was number of people they were actively chatting with. One participant knew there were new messages but was unable to differentiate new messages from old ones. Similarly, pop-up windows or modals used in Facebook Messenger were difficult for the participants to interact with and understand. Some modals currently do not have a clear "close" or "cancel" button that would close the modal. Tapping out of the modal area would automatically close the modal. This interaction was not intuitive to the participants.

These commonalities are useful to a designer though, in recognition of the inclusive design dimensions, it is vital to also understand each participant's unique and diverse experiences as that is what will help create an inclusive design. While personally identifying each of their experiences and highlighting moments, it is valuable to also use a visualization tool.

6.2 Inclusive Design Mapping Tool

A visualization tool makes it possible to easily compare different experiences and identify the specifics of how they differ. Furthermore, we can also map out an application and identify who is disempowered

by the attributes of the application. The map below is like a six slice pie, with each slice representing a different category; "learning management" refers to the style in which the participant feels the most comfortable gaining a new skill, "temporal" refers to the attention span in which the participant feels comfortable concentrating, "sensory" refers to the spectrum of senses and the participants ability to use them to engage, "cognitive" relates to the complexity in which the participant feels comfortable receiving information, "device platform" refers to the technology that the participant has access to, and "social" refers to the community that the participant engages with and how they do so. Each of these slices were chosen based on participants experience with Facebook Messenger.

The tool is intended to be adapted to the situation. The facets were chosen based on participants' experience with Facebook Messenger. Each participants experience was mapped out against what Facebook Messenger offered to highlight the difficulty in use. This tool also helped identifying what is required to improve participant's experience with the application.

DEVICE SUPPORT

LEARNING METHOD

SOCIAL

SENSORY

DEVICE PLATFORM

COGNITIVE

- Help and support available (live chat)
- teach users through instructions & excercises
- instructions & support during task
- Onboarding information
- Self-directed
- Rare meet ups
- Occasional meet ups
- Socially active online
- Socially active online and offline
- Socially active offline
- Manual/book based learning
- Classes, support groups
- Family and friends based learning
- Instructions based learning
- self-directed learning
- needs an alternative to still audio
- needs to enhance audio
- Can hear well
- Can speak well
- needs an alternative to audio instructions
- needs to enhance visibility
- needs an alternative for touch interactions
- needs an alternative to colours
- Understands content in various formats
- has a large display
- has a small device with a large display
- has a modern computer
- has a device with a small display
- has a non-smartphone
- has no phone
- has an outdated computer
- doesn't have a computer at all
- Understands complex page layouts
- Understands modern visual elements
- needs simplified layout
- needs simplified content
- Needs multiple modalities for interaction

Figure 5: Inclusive design mapping tool

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Facebook Messenger was first released five years ago and has basic onboarding instructions, but expects a user to learn how to use it through experience. It is adaptable from a temporal standpoint, as it can be used for a minute or twelve hours surprisingly easily. It does require that a user can see well and easily understand organized content. The application can be downloaded for use in a variety of operating systems and devices, including smartphones, tablets and computers. It is usable in almost all social contexts, though certainly frowned upon in graduate school lectures.

Below, I have mapped Facebook Messenger on the inclusive design visualization tool. Notably, as a social online network, it adequately facilitates a range of social and device platforms, though is clearly limited in accessibility from a sensory and cognitive standpoint.

Figure 6: Facebook inclusive design map

Data from each participant will be categorised using the inclusive design mapping tool to identify every participant's diverse needs and how the application can be designed to meet their needs better, as we progress through their individual experiences. When these two maps are compared, it will be clear where the barriers in

interaction are and how the application is ignoring some of the unique requirements for each participant.

6.3 Participant 1
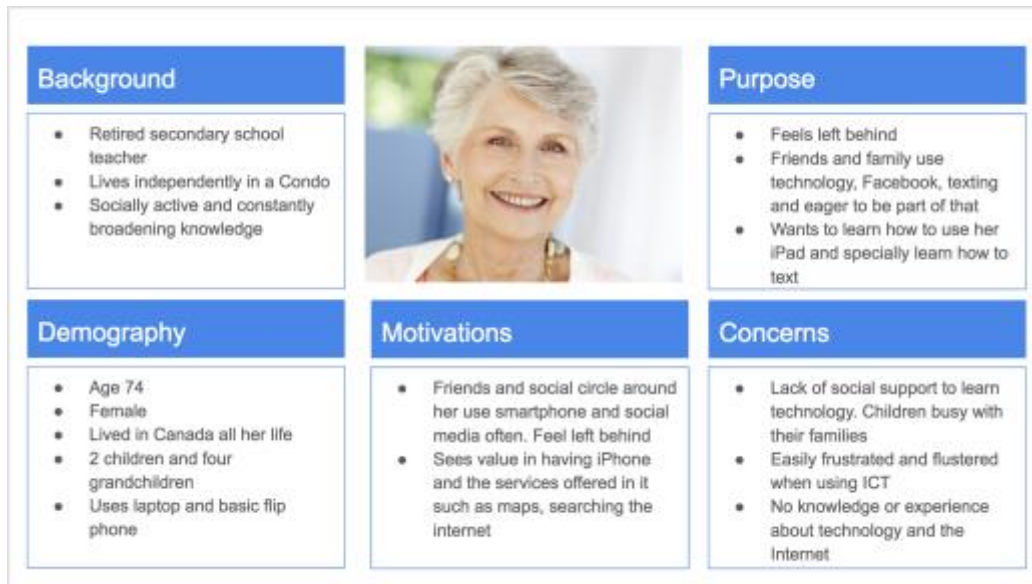
Figure 7: Persona of participant 1

Participant 1 was initially hesitant to join the research when she heard of it as she thought her computer skills were inadequate to provide valuable feedback. Her primary goal for joining this study was to improve her skills, learn how to text on a touch screen device, and create a Facebook account as her friends utilize it.

Living independently in a condo in west side of Toronto, Participant 1 was independent and kept herself busy by meeting friends and family, and attending free courses at Ryerson to broaden

her knowledge. As she lived by herself, Participant 1 felt that technology had gotten away from her as she did not have anyone around to help when she stumbled into a problem or guide her when exploring new technologies. This lack of social support was frequently mentioned in our conversations.

> I think what has happened with the technology in my case, it's kind of gotten away from me in that I live on my own, there is not someone to turn to say, "Hey, how do I do this?" "Hey, what is this for?" And then you have to kind of do it on your own and you tend to struggle a bit, and I don't have the world's greatest patience.
>
> - Participant 1, first meeting.

Through the inclusive research process and the inclusive design mapping tool, I was able to identify Participant 1's unique context and requirements. During my meetings with Participant 1, I had to be careful of the terminologies I would use when describing different elements of the application or device. Participant 1 was not familiar with words that are commonly used on the web such as "share", "wifi", "download", "app". She often referred to desktop as screen, click as hit and many other instances which highlighted the gap in language used in regards to technology. Participant 1 found it difficult to interpret some of the languages used within Facebook Messenger as well, such as "active now", "people" and "more conversations", which are used to identify the different categories and menus.

Majority of the user interface on Facebook Messenger is graphical, meaning icons are used to represent categories, actionable elements and interactive elements. These icons were not relatable to Participant 1, and she would often write down what the icon represented to remember it's functionality. This further emphasized the importance of language used in an application and why it needs to be easy to understand by all users, regardless of age and frequency of use. During our co-design session, Participant 1 suggested that Facebook Messenger provide a printed manual that explains the application and its functionality in detail. Facebook does have a help centre that was pointed out to Participant 1, but her experience supported why someone who is unfamiliar with technology can benefit from a printed manual.
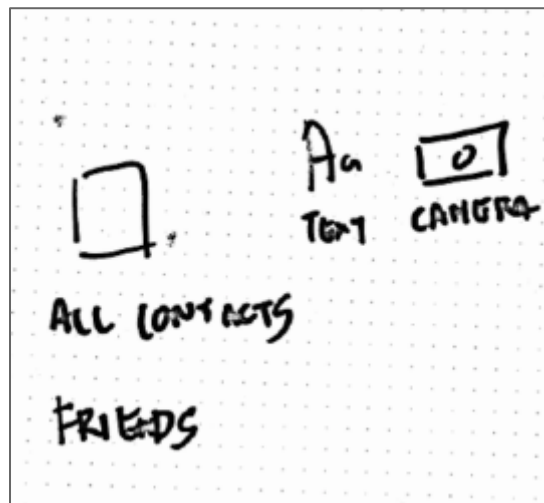
Figure 8: Participant 1 co-design session artifact

Another suggestion was in regards to labels being used and how it needs to be more explicit, such as "Friends" instead of "People". She also suggested that all icons should have text present as that would describe the functionality, it could be an optional feature as she thought not everyone would require descriptions but some people would definitely benefit from them.

Overall, participant 1 was glad she took part in the research and felt she improved her computer skills and was more willing to explore the iPad and Facebook by herself without any support. The inclusive research process allowed me to identify that social support was an important motivational aspect to adapting to technology for this participant. It provoked me as a researcher and designer to become more aware of how I communicate user experience design when talking about ICTs to people who might not be familiar with it.

Figure 9: Position of participant 1 on inclusive design mapping tool

6.4 Participant 2

Figure 10: Persona of participant 2

Participant 2 was energetic, self-motivated and taught herself how to use a computer and smartphone. She lived in a low-income seniors' home and made use of the special offers available to her such as a low cost WIFI connection, though other residents I interacted with were not aware of such offerings. Participant 2 would help set up email and Facebook accounts for her friends who were not familiar with technology. Participant 2 believed that technology has benefited her a great deal, especially being an immigrant and away from her home country, Sri Lanka. She also felt that technology has boosted her self-confidence and believed she needs to constantly learn new things as it helps her stay youthful. Participant 2 heard about the study through the Toronto Intergenerational Partnership Program and was excited to

explore an iPad, a device she didn't own and wanted to test before purchasing.

During my meetings with Participant 2, I noticed she learned and adapted to new technology with ease. Her typing on a touch device was effortless. After exploring the iPad during our first session, Participant 2 had gone through all the available applications and settings. She messaged me a few hours after our session asking how to watch a movie on the iPad. Participant 2 also found ways of using Facebook Messenger as bookmarking tool. She would often send herself any interesting articles or information she came across when browsing the Internet. She found the way messenger presented links was easier to identify than using the browser bookmarking tool. This also made it easy for her to share the link on Facebook or send it to her friends via Messenger.

Participant 2 had two main concerns during the design project. While she liked the portability of the iPad, she found it difficult to hold due to dexterity limitations. She had arthritis and found it strenuous on her neck and hands when using the iPad. She recommended a cover or stand for the iPad that will that would relieve the stress.

Another issue Participant 2 kept stumbling upon, and it was not limited to the design project, was unknown people adding her and

contacting her on Facebook. Participant 2 had an active Facebook account with over 900 friends. She often gets contacted by people from Sri Lanka regarding Canada and opportunities to move or work here. She enjoyed being of help to people and would share her experience of moving to Canada. Still, there were many other requests and inappropriate messages from people that bothered Participant 2 deeply. During our second interaction, she asked if there was to block people through messenger as she was not able to find such an option and ended up blocking people through logging on to Facebook from her laptop. I mentioned that there are block options available on Messenger and there is also a way for people to stop receiving messages from people who are not part of your network. She suggested these options should be made more prominent and not hidden under the privacy section on Facebook.

Figure 11: Journal entry of participant 2 at the end

Overall participant 2 enjoyed exploring Facebook and Messenger on the iPad and felt that the layout was clean and uncluttered, unlike the website. Her overall outlook to technology was positive and always wanting to learn more.

Figure 12: Participant 2's position on inclusive design mapping tool

6.5 Participant Three
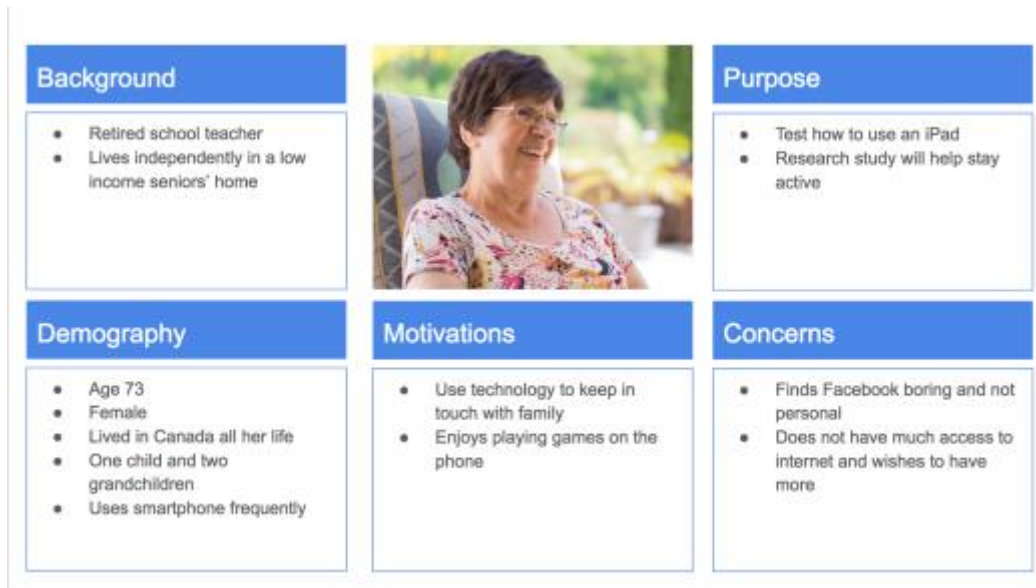
Figure 13: Persona of participant 2

Participant 3 also lived in the same low-income seniors' home as Participant 2 and had a different outlook to technology and Facebook. She was getting tired of Facebook but used it because it helped to keep in touch with family members. Her children lived away from her and she felt disconnected from them, and Facebook provided updates about their lives.

> …my daughter will call me... And then I say to her, you are a woman of few word... I said, 'You guys should check on me, at least once a week, to make sure I am alive or something.

There were many aspects of Facebook that Participant 3 did not like, explaining why she was getting tired of it. She felt the information people shared on Facebook was useless or unnecessary:

Well, like my friend, Trudy, she's 62. She's retired and she's on here. I mean, I think she puts some, like "Oh, the Blue Jays are winning 3-2". Yes, I know. I'm watching the stupid game myself, you know? Or she'll say, "I'm watching the hockey or I'm watching the basketball" and she does a lot of news stuff? And I mean, I'm watching the news so I don't need you to tell me.

She also did not like how Facebook constantly sent her notifications when people commented on the same post she did or if they "liked" her comment. She found those notifications annoying and pointless.

Despite her dislike towards Facebook, Participant 3 used it daily. Her experience with using Messenger on the iPad was not smooth. Unlike Participants 1 and 2, Participant 3 did not have WIFI at home. She had access to a computer room in her seniors' home that had WIFI, which required her to step outside her house to use the iPad. Sometimes the computer room was locked, leaving the participant with no access to internet. The participant also had an internet plan of 1GB on her phone, which limited her browsing, content intake and even making video calls to family and friends. Due to the limited internet plan, Participant 3 could not spend much time online even though she wished she could.

Apart from limited internet access, Participant 3 found it hard to interact with a touch device. She used a stylus for her smartphone as

she found typing with her fingers to be difficult. As majority of the interactive elements surface area is small, it often led to unintended errors. With the iPad, Participant 3 found it easier to type and didn't use her stylus. The interactive elements were bigger and on a larger screen compared to her smartphone. She liked that there were two different views: landscape and portrait. Portrait was beneficial when reading and landscape was beneficial when typing.

Having experience using Facebook and Messenger on her phone, Participant 3 was confused about some of the elements that were present on the iPad. She knew certain functions and interactions and relates them to the device, unable to translate that knowledge in a different device. She suggested having more information available about each interactive element, which would help her remember the functionality. She suggested a long press on an item could have an accordion that has more information about that element.
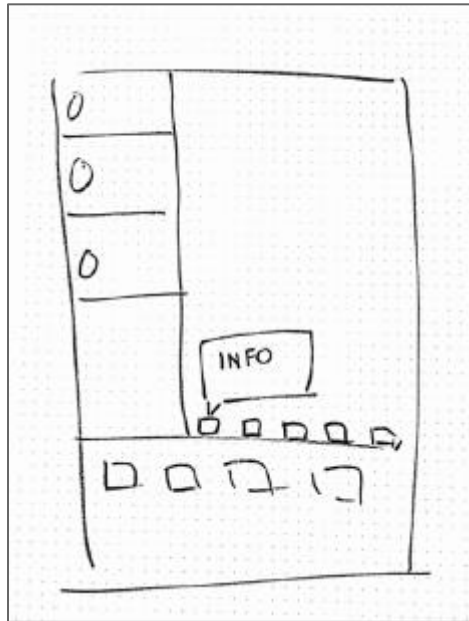
Figure 14: Participant 3 co-design session artifact

At the end of the study, Participant 3 wanted to purchase an iPad and install WIFI in her apartment. She saw the usefulness of having access to the Internet and came to know about the low internet rates for low income seniors home through Participant 2 during the design project.

Figure 15: Participant 3's position on inclusive design mapping tool

6.6 Analysis of Visualization Tool
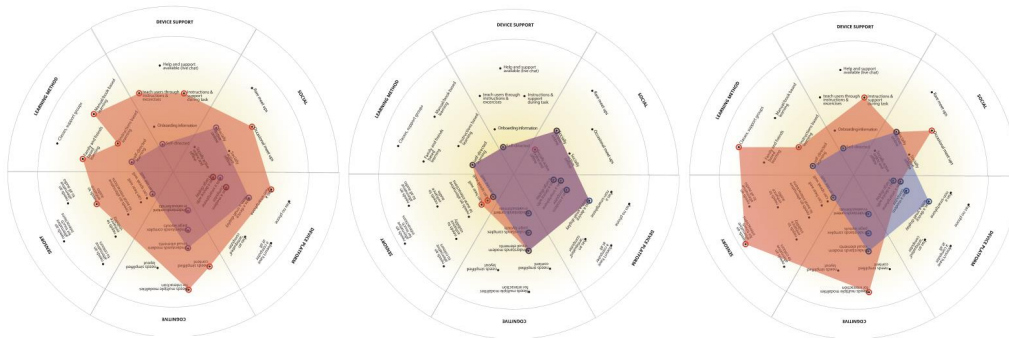
Figure 16: Participant's position on inclusive design mapping tool

The inclusive design mapping tool allowed me to identify and visualize how accommodating Facebook Messenger is to the diverse needs of the participants in this study. Evaluating user requirements against what the application offers is a useful method to identify and contextualize where the pain-points are for the user and what changes could make for a more inclusive experience (by "stretching" the design to encompass their requirements). Through the tool, I was able to recognize how Facebook Messenger does not seem usable and adaptable to marginalized users in this study as the application heavily relies on sight and visual ques.

While this tool helps position where the user lies in the experience of the application, there is room for misusing the tool. As the tool provides slices and elements under each slice to help identify what is appropriate for a research study, it must be adapted for the context of specific studies. Each slice and elements within a slice can

be customized according to a researcher's questions and the participant's needs. By allowing for such customization, the tool is able to capture the unique requirements of each participant, which supports the inclusive design process. In my research, I customized some slices of the tool. One example of this is the temporal slice, which contains the following; adapts to all interaction, prefers longer interactions, prefers shorter interactions.
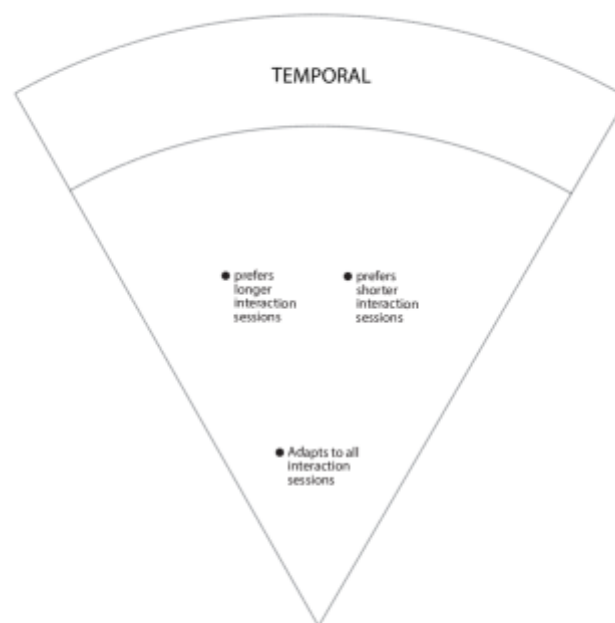
Figure 17: Temporal section of inclusive design mapping tool

The term of "adapts to all interaction sessions" means that it is inclusive regardless of what the user prefers, yet it is placed closer to the centre of the pie. If "adapts to all interaction sessions" is placed on the outer part of the slice, it communicates a more inclusive

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experience, one that facilitates both longer and shorter interaction sessions.
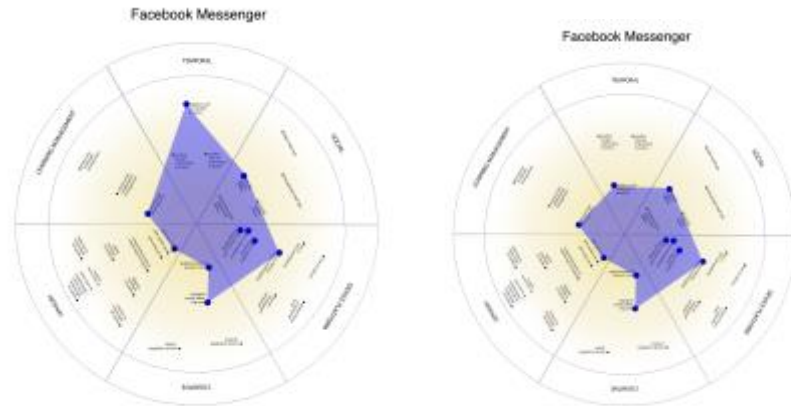
Figure 18: Facebook Messenger's position comparison

The contrast of the two maps proves that each item on the mapping tool needs to be evaluated and adjusted according to the study. The IDRC provides various user requirements and contexts but it is essential to evaluate these slices according to the participant or application being tested. I also modified the social slice so that it was able to capture each participant's requirements such as: socially active online, socially active offline, socially active online and offline, occasional meet ups and rare meet ups. These categories identified each of the participant's situations and how well Facebook Messenger was serving them.

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The benefit of this tool is that researchers are able to customize it depending on the research topics and the participants' experiences. The tool is inclusive but it needs to be carefully evaluated and modified to meet the requirements of the research, and to ensure the visualize model is consistent across each slice. The ability of such customization gives room to broaden the researcher's perspective of how to evaluate participant data and has opened my mind to be more aware of assumptions.

7 Design considerations

There are numerous guidelines and best practices that list what needs to be considered when designing for the aging population. The Web Content Accessibility Guidelines (WCAG) is often referred to for accessibility compliancy that is regulated by various governments. In Ontario, there is an Accessibility for Ontarians with Disabilities Act (AODA), which also follows the WCAG guidelines for digital accessibility. It has specific dates by which various types and sizes of businesses need to be complaint. This forces all business to ensure their online content is accessible for people with disability. WCAG has various versions and WCAG 2.0 is said to improve the accessibility and usability of websites and web applications for older people. (Web Accessibility Initiative, 2010) WCAG is constantly improving its guidelines to better meet the changing needs of all users. These standards and new standards are a good directional step towards creating a more inclusive experience that meets the needs of seniors.

Apart from the WCAG guidelines, there is a significant body of literature, research and UX forums that are constantly identifying how to design for senior populations. The Nielsen Norman Group that was created by Don Norman and Jakob Nielsen, pioneers of user experience design and usability, have published a book called "Senior

Citizens (Ages 65 and older) on the Web". The book offers 106 design guidelines based on their usability research that covers how seniors approach technology; their performance, tendencies and behaviors, physical and cognitive traits that affect experience, and recommendations on how to make websites easier and more engaging for seniors and also their methodology of how they conducted their study. (Nielsen, 2013)

The benefit of such books and resources is that it meets the requirements of the fast-paced IT industry. Due to time and resource limitations for many companies, it is beneficial to have organizations that focus on usability and are constantly testing how applications perform, beyond the compliancy requirements of WCAG.

8 Conclusion

From this design project, I have found the inclusive design process to be valuable. It allowed for participants of the research to become active agents of a design process. The participants proved to have expert knowledge as users, having the lived experience of how ICTs are not accessible or usable for them specifically. The focus of the process shifted from participants providing feedback to contributing to the design of the application. This led to identifying various pain-points in user experience that might not have been possible if I, as a designer and researcher, had only inferred from their feedback.

From the design consideration section, it is clear that having WCAG standards and constantly improving them is a step towards creating more inclusive experiences. From my experience, WCAG standards are beneficial, though it is often looked upon as a government mandate and only applied in large corporations when strict penalties exist. These standards ensure that in the next ten years, websites and web applications will be accessible for people living with disabilities. This does not adequately take into consideration the broader needs and specifications required by different users, such as seniors. The various guidelines from literature, design companies and UX forums are a means to providing short-term solutions to the IT

industry, yet it needs to be further researched and tested to see how beneficial these guidelines are.

While WCAG provides users alternative mechanisms to interact with a website or application, the burden of personalization is dependent on the user and their ability to access specialized equipment or training. It would be valuable to investigate methods that shift the burden of personalization from users to applications, where applications are able customize according to a user's unique preferences. Further exploration into how users can save their preferences in one application and transfer them into another application, regardless of platform or device, would reduce the burden on the user. In this case, users would not be required to learn new interactions and behaviours but the application would instead be able to adapt to the user.

WCAG standards and other guidelines still focus on providing support to designers and does not take into considerations the role that senior users can have in the design process. The inclusive design process does focus on allowing such users to become active-agents and co-design solutions with designers. Unfortunately, the inclusive design process is resource heavy, as it requires significant time and investment to be successfully implemented. Most IT companies work in

a fast-paced environment, where projects follow an agile methodology of multiple iterations of design, build and testing. It is not possible for the inclusive design process and framework to integrate into existing processes followed in the IT industry.

While there are companies that purely focus on usability, and conduct research for other companies and share their feedback, such processes still follow the norm of "collecting feedback" from users and providing it to designers to infer from.

8.1 Contribution and Recommendation

This design project has allowed me to recognize the tremendous value in engaging outlier users in the design process. My recommendation for IT industries to build more inclusive, usable and accessible applications is to a) incorporate WCAG and other requirements during the initial stages of project development and b) more importantly, create diverse design teams. Diverse design teams will consider human diversity and include people with varying ability, age and culture. This removes the separation of users and designers, and allows for co-design to happen throughout the life cycle of an application.

Inclusive design can be perceived an as ideal process of design that allows for every user, regardless of their ability, to be able to

access and interact with an application with equal ease. While the limitations of a company may not allow for a full-fledged inclusive design process, gradients of it would be a step towards building an inclusive experience and broaden the user base. Diverse design teams will naturally recognize diversity and uniqueness; they will be able to identify the variety of needs that users have, breaking the notion of "average user" because everyone strays from the average in some way.

Diverse design teams would resonate with the edict "nothing about us without us". Through this mechanism, unique requirements will be integrated into project scope instead of being an afterthought, an added feature.

The impact on design would be significant, resulting in adaptable and customizable experiences that can meet the needs of a wide range of users. Encompassing the three dimensions of inclusive design - diversity and uniqueness, inclusive process and tools, and broader beneficial impact – is a valuable and lucrative model to use when designing ICT applications. Furthermore, by doing so successfully, ICTs can become a mechanism for an improved society through engagement of senior populations.

IDEO, a leading design agency, has started bringing diversity to their team by hiring a 91-year-old women, Barbara Beskind. She says "Everybody who ages is going to be their own problem-solver," and that she is thankful that she is a designer as "it makes aging more tolerable, more enjoyable". (Sydell, 2015) The associate partner at IDEO hired Beskind and said, "When Beskind is in a room, young designers do think differently." (Sydell, 2015) The very presence of diversity in a design team can change the way designers think and perceive. This can also influence the process of ideation and iteration.

There is evidence that diverse design teams can be beneficial to designers, and I anticipate that companies that integrate diversity into design teams will be creating products that serve a broader user base successfully. Further research needs to be conducted to identify what is the impact of having a diverse design team.

9 Final thoughts

This design project has changed the way I think about design processes when building applications, specifically social applications that we use on a daily basis and take the ease of use for granted. It has made me aware of my comfort with technology and yet cautious that it might not always stay the same.

Through interacting with my participants, I became more patient in supporting them as they faced challenges, but I soon realized that my support was not sufficient to sustain an improved experience.

Creating diverse design teams is a step towards acknowledging that everyone has different abilities and skillsets that can contribute to the design process. While seniors might not specialize in design as a profession, they have the lived experience of struggling with technology that can help identify design failures earlier in the product life cycle.

I have begun implementing my learning from this research at my workplace and have started noticing the benefits of diversity within teams. Surrounding designers with alternative perspectives makes them aware of their biases and pushes them to approach solutions in an inclusive manner.

I hope we are able to create social applications that help the aging population be an active part of society. It was upsetting to not be able to support and communicate with my grandfather during his last days. While I cherish our memories, I wish the distance had not reduced our relationship. Living in a modern world where families are growing further apart, it is important that we are able to keep in touch regardless of distance, age and ability.

I hope this design project is valuable to professionals, academics, and designers working towards reducing the digital divide.

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