TACTILE MEDIA: FACTORS AFFECTING THE ADOPTION OF TOUCHSCREEN SMARTPHONES AMONG CONSUMERS WITH VISION LOSS

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Touchscreen technology is on the rise as the new standard in smartphone design. But, the usability of touchscreen is hindered for consumers that lack the physical ability to navigate such devices. Two focus groups were conducted in order to identify specific uses and gratifications that people with visual impairments had when using mobile phones. Additional questions were presented to the participants to determine if touchscreen technology limited access to communication and entertainment. The responses revealed an upward trend in touchscreen smartphone adoption among the participants. These users chose to adopt touchscreen smartphones that had built-in and downloadable assistive features that contributed to user-friendly designs.

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CHAPTER 1

INTRODUCTION

Traditional forms of media, such as television, radio, and newspapers are taking on new platforms of distribution. In recent years consumers have adopted an innovative approach to receiving information by utilizing mobile media devices. Technology that fits in the palm of the hand keeps users connected to the world through instant data processing and transmission. These handheld communication devices, including smartphones, personal digital assistants (PDAs), and tablet personal computers (PCs), have become streamlined in design as the human capacity toward multitasking leads to innovations in user interfaces. The latest trend in handheld technology is touchscreen design.

Touchscreen technology is becoming ever so popular with manufacturers and users and is on the rise as the new standard in device design (Brewster, Hoggan, & Johnston, 2008). There is no need for a physical keyboard to take up space on the device. Instead, the space previously dedicated to a keyboard can now be allotted to a larger screen, meaning a better image display. Mobile media devices are equipped to operate within the known capacities of human functions, at the same time, such devices are specifically designed to influence the way in which users interact and receive media. A horizontal sweep of the finger to unlock the screen, a vertical sweep scrolls through application features, or spread two fingers apart on a photo to zoom in. These gestures on the touchscreen interface make the user feel as if they are intuitively manipulating an object (Selker, 2008).

However, the usability of the touchscreen device would be lost on any consumer that lacks the physical ability to operate the device. For example, users with visual

impairments are unable to clearly see what is on the screen. There is no trackball to act as a tangible point of reference and the tactile QWERTY[1] keyboard, with texturized keys, is also missing. The fact that these specific users have memorized the key placement on older phone styles does not matter if the current touchscreen design has an unreadable display.

This thesis asks whether or not consumers with varying ranges of vision loss choose to adopt touchscreen smartphones[2] outfitted with assistive software features. In addition, this investigation hopes to identify the attitudes this consumer group has with regards to the theory of inclusion in a mobile media society. A timeline of mobile media convergence and its prominent role in the everyday lives of consumers will be examined. Next, a comparative analysis of the most popular touchscreen smartphones on the market will examine the current trends in hardware design aimed at encouraging or deterring use by consumers with vision loss, followed by a look at current accessibility regulations in telecommunications. Finally, a series of focus groups will be used to determine the factors influencing touchscreen smartphone purchasing decisions for consumers with vision loss.

Mobile Communication

A mobile media device is defined as the primary source of portable media from which a user can obtain information on-demand and communicate with one another regardless of the user's location from a wired source (Garrard, 1997). There is an abundance of technology across mobile media devices, but this study will specifically

[1] The most common keyboard layout used for computers and mobile devices.
[2] The term smartphone will be used to distinguish differences in computing capability and Internet connectivity between generations of cellular phones. Current models have high-resolution screens, web browsers, GPS navigation, and Wi-Fi and mobile broadband access.

look at the designs and modalities of smartphones. Nevertheless, the theories investigated here can be extended to a variety of portable devices, including smartphones, PDAs, and tablet PCs.

By the 1950s, talking over telephone circuits had become a conventional way to keep in touch with friends and family and to conduct business. But new technical advances in wireless communications started appearing as early as World War II with the design and manufacturing of two-way radio sets by General Electric and Motorola (Huurdeman, 2003). In 1978, the Federal Communications Commission (FCC) called for industry proposals for better mobile telephone systems. The Advanced Mobile Phone System, proposed by AT&T, gave the telecommunication industry the first-generation of analog cellular phone service (Young, 1979). Motorola was a leading manufacturer of cellular phones in the 1980s; however, these cellular phones were not truly portable due to their weight of two or more pounds. Portability is foremost to cell phone culture, but was not realized until the digitization of information and data communication in the early 1990s with the second-generation of cellular phones (Goggin, 2006).

Connectivity, reception, and voice quality were all improved with the process of digitally encoding and encrypting the voice signal and transmitting it over radio waves. The applications of the cellular phone, such as the address book, alarm function, and calendar feature also became digitized and standardized. Additionally, digital technology influenced the exchange of information via text messaging. Coinciding with the advent of email, the short message service (SMS) allows phone users to key-in characters via the alphanumeric keyboard of their device, compose short messages, and send these

to other phone users (Taylor & Vincent, 2005). Its successor, the multimedia message service (MMS) allowed larger data messages to be sent, including messages with photo, audio, and video attachments.

At the beginning of the twenty-first century, the wired telephone had been surpassed by its mobile counterpart (Goggin, 2006). In 2010, there were an estimated 5 billion cell phone subscribers, compared to the worldwide population of 6.9 billion people (Parkes, 2010; Haub, 2010). Mobile technologies and wireless networks play a crucial role in the everyday lives of consumers (Goggin, 2006). The evolution and popularization of the Internet has increased the demand for media content over telephone networks. Third-generation (3G) technology allowed for the faster data transmission required for Internet access over cellular phones. Once separate, Internet and media communication are now synonymous with cellular phones.

A range of social and entertainment activities revolves around these interlinked technologies. Staying in constant contact, updating profiles, surfing the Internet, e-commerce, interacting with television programs, and listening to music are activities often performed through cellular phones. Media companies research consumer habits and are responding to the changing patterns in a user's time spent with media. For example, the television and film industries are experiencing a shift from traditional television and DVD distribution to deliver content directly over the Internet via applications such as YouTube, Netflix, and Hulu (Anderson & Wolff, 2010). Visual content and streaming music take more bandwidth to transfer, but 3G and Wi-Fi networks have demonstrated the ability to deliver clips, specifically in the news and entertainment content business, via mobile devices. With the ability to comprehend

information in shorter, more fragmented ways, consumers have become more interested in smaller, portable technologies.

Senior Vice President of News Corporation, Lucy Hood, describes the emerging smartphone market as a lucrative content delivery market; “You always have your phone with you. If you can pick up your phone and see one minute or five minutes of media that you enjoyed, that’s a rich media experience in its own way” (Hanson, 2007, p. 109). Smartphone providers specifically believe the market is a younger segment of the population who tend to upgrade their phones regularly and who are among the most mutable members of society (Hanson, 2007). A multitude of prevailing technical specifications, network speeds, and user interfaces are available to consumers.

Touchscreen Technology

The electronic screen detects the presence and location of a finger within the display area. The main attribute of a touchscreen is that it allows the user to interact directly with what is displayed, rather than indirectly with an intermediate device such as a mouse. The first touchscreen was patented and developed in 1977 by Dr. Sam Hurst of Elographics, now Elo TouchSystems (Brown, Steinbacher, Turpin, Butler & Bales, 2010). Their design, the elograph, was a computer input device that utilized resistive touch technology.

There are two major categories of touchscreen displays: resistive touchscreens and capacitive touchscreens. Resistive touchscreen displays are composed of multiple layers that are separated by thin spaces. Pressure applied to the surface of the display by a finger or stylus causes the layers to touch, which completes electrical circuits and tells the device where the user is touching. Resistive type touchscreens require much

more pressure to activate than capacitive touchscreens. Capacitive touchscreen displays rely on the electrical properties of the human body to detect when and where on a display the user is touching. Because of this, capacitive displays can be controlled with very light touches of a finger and generally cannot be used with a stylus (Ricks & Smith, 2007). Studies indicate that the sensitivity of capacitive touchscreens increases input error (Brewster, Hoggan, & Johnston, 2008).

Touchscreen displays have demonstrated acceptance among consumers. Display manufacturers worldwide have acknowledged the upward trend in adoption and have begun to integrate touchscreen functionality into the fundamental design of their products. These screens can be found in automobiles, gaming consoles, appliances, hospitality kiosks, and ATMs. With the growing use of touchscreens, the marginal cost of the technology is almost eliminated. The touchscreen market for mobile devices alone produced $5 billion in revenue in 2009 (ABI Research, 2008).

Four of the most recognizable cell phone operating systems are Apple Inc.'s iOS, Google Inc.'s Android system, Microsoft Corp.'s Windows Phone, and Research In Motion's[3] (RIM) BlackBerry OS. The user interface design is different between these four platforms. Additionally, hardware design is not standard. Android, Windows Phone, and BlackBerry operating systems can be found on devices that have a physical QWERTY keyboard, or an on-screen keyboard, or both. The device hardware of the iPhone, however, is exclusively touchscreen.

The iPhone introduced millions of consumers to a gestural, multi-touch interface. Developers at Apple researched and identified various usage scenarios for the iPhone

[3] As of December 2011, stock in RIM dropped by 77% due to continuous market share losses to iPhone and Android phones (Miller, 2011).

and created a gestural operating system utilizing finger sweeping and finger pinching as means of screen navigation. Quarterly reports show that over 89 million iPhone handsets have been sold since its launch in 2007, increasing the demand for more touchscreen vendors of mobile smartphones. Companies such as Synaptics and ALPS and other component manufacturers of touchscreen products have removed the physical keyboard from other devices, such as digital cameras and music players. Boosting the advancement of human-computer interaction, multi-touch technology is supposed to be simple to use and increase productivity. Additionally, more socially positive experiences are accepted to occur (Barnes, 2003).

But for some consumers, touchscreen design might introduce a technology gap due to the disregard for accessible design for all users. Although the on-screen keyboard used on touchscreen devices is based on the appearance and key placement of a physical keyboard, one important feature is missing: the screen cannot provide the tactile response that physical buttons do when touched or clicked. Without the tactile feedback, users rely on visual and audio cues. Such cues can be ineffective in real world situations that compromise a user's ability to see (Brewster, Hoggan, & Johnston, 2008).

Vision Loss

An estimated 25 million Americans have some form of vision loss (National Health Interview Survey, 2008). However, there is a lack of clarity about the terms used to define vision standards. The International Council of Ophthalmology has recommended terminology to better identify aspects and ranges of vision loss. For the purposes of this study it will be understood that blindness is defined as total vision loss

that requires one to develop vision substitution skills. These skills require individuals to rely heavily on other senses, such as hearing and touch in order to complete daily activities. Low vision is categorized as a lesser degree of vision loss where individuals find assistance with vision enhancement aids and devices (International Council of Ophthalmology, 2002) such as vision magnifiers.

Participants of this study will be asked to identify their range of vision loss due to disorders of visual acuity, otherwise known as sharpness of vision, and disorders of field of view. These ranges are categorized as moderate vision loss, severe vision loss, profound vision loss, and total vision loss as identified by Early Treatment Diabetic Retinopathy Study (ETDRS) letter charts. The ETDRS chart is a type of Snellen chart developed by ophthalmologist Herman Snellen in 1862 (Hussain, Sivaprasad, & Hammond, 2006) for visual acuity testing. This test is based on letter recognition from a specific distance to the chart to determine the sharpness of vision in each eye. During the exam the individual stands 20 feet from the letter chart and attempts to read rows of letters. These rows become smaller in size as they descend, with each row having a corresponding value of visual acuity, from low acuity to high acuity. For example, the notation 20/20 represents normal vision. If an individual is tested as having 20/40 vision the notation means the individual sees letters at 20 feet that someone with normal vision could successfully distinguish from 40 feet away. Table 1 demonstrates the relationship between visual acuity and reading ability.

Table 1

Estimates of Reading Ability

Ranges of Vision Loss	**Visual Acuity** (U.S. Notation)	**Estimates of Reading Ability**
Normal Vision	20/12 20/16 20/20 20/25	Normal reading speed, at normal reading distance
Minimal Impairment	20/32 20/40	Normal reading speed, at reduced reading distance
Mild Impairment	20/50 20/63	
Moderate Impairment	20/80 20/100 20/125 20/160	Near-normal reading speed, with appropriate reading aids
Severe Impairment	20/200 20/250 20/300 20/400	Slower than normal reading speed, with reading aids
Profound Impairment	20/500 20/600 20/800 20/1000	Visual reading is limited
Near-Blindness	Less	No visual reading
Blindness		

Source: International Council of Ophthalmology (2002).

Tests using the ETDRS letter chart do not measure an individual's field of view. Field of view is defined as the area encompassing the sight of both eyes from the peripheral field to the direct line of sight (International Council of Ophthalmology, 2002). Loss of peripheral vision or the occurrence of excessive blind spots in the central field of view is known as visual field loss. This type of vision loss is independent from visual acuity. There are several tests that identify visual field loss, but the most common test is

for the individual to focus the eyes straight ahead and identify objects within the peripheral and central field of view. For example, an individual that can see 120° of their field of view is classified as having normal vision. But, an individual that can only see 80° of their field of view has mild impairment, possibly due to peripheral vision loss. Visual field loss has an impact on a person's orientation to the world, and can affect mobility performance (Wiener, Welsh, & Blasch, 2010). Table 2 demonstrates the relationship between peripheral visual field loss and visual orientation and mobility.

Table 2

Estimates of Visual Orientation and Mobility

Ranges of Vision Loss	**Visual Field (**Diameter)	**Estimates of Visual Orientation and Mobility**
Normal Vision	120°	Normal visual orientation, normal mobility skills
Mild Impairment	100° 80°	Normal visual orientation, normal mobility skills
Moderate Impairment	60° 40°	Near-normal performance
Severe Impairment	20° 16°	Visual mobility is slower than normal
Profound Impairment	12° 8°	Limited visual mobility
Near-Blindness	4°	Visual orientation unreliable
Blindness	0°	

Source: International Council of Ophthalmology (2002).

Sharpness of vision and range of vision are abilities needed for daily activities. Both contribute to compromised reading ability on handheld touchscreen phones. Some

individuals may have better skills than others, although they share the same acuity loss. Causes for vision loss can be congenital, progressive, or abrupt. Therefore, for this thesis it will be important to identify each participant's personal condition and usage of assistive technology.

Assistive Technology

The National Council on Disability (2000) defines assistive technology as any product or system, "whether acquired commercially off-the-shelf, modified or customized, that is used to increase, maintain, or improve the functional capabilities of individuals with disabilities" (p. 2). These help individuals overcome or remove a disability, enabling them to experience increased independence, workforce participation, and opportunities in leisure and recreation.

Some mainstream technologies are produced with accessibility built-in, utilizing the principles of universal design[4]. Text magnification and speech recognition software are two examples of innovations that enable accessibility for people with visual impairments. The iPhone has a built-in application called Zoom that allows the user to adjust the entire screen's magnification by 500%. Those who need higher color contrast in order to increase reading ability can change the display setting to "White on Black" (Apple Inc., 2010). The iPhone operating system also has a built-in, text-to-speech feature, called VoiceOver that converts the selected text information on the screen into speech. Android and Google platforms have similar built-in software for magnification and text-to-speech.

[4] Universal design is a principle that advocates the operability and simplicity of products for all users (Lidwell, Holden, Butler, & Elam, 2010).

User interface customization is important to accessible design. For consumers that have not adopted smartphones from the most recognizable brands, third party companies have developed software programs for upload to mobile devices. Mobile Magnifier is screen magnification software for Symbian[5] cellular phones. It enlarges and enhances all items of the phone display, automatically detecting and magnifying the area of interest as the user navigates through the phone (Code Factory, 2008). Third party software varies in price based on cell phone plan and software bundles. For example, Mobile Magnifier can be purchased as an optional add-on to the KNFB Mobile Reader[6] software bundle. The bundle includes Mobile Reader, which allows the user to take a picture of print and have the software read the print back to them; and Mobile Speak, which generates text-to-speech. These three programs can be purchased for a total of over $1,500, before adding the cost of the cell phone (Audio Optical Systems of Austin, Inc., 2009).

Although there are numerous downloadable applications, some mobile platforms simply lack compatibility. In 2010, Microsoft announced that the Windows Phone 7, exclusively touchscreen, was not accessible for the blind and visually impaired. The company decided not to have built-in features or promote third party solutions since it was not technically feasible to build the infrastructure needed to support screen-reading software (Bridges, 2010).

In order to increase the telecommunications sector's investment in accessibility features more research needs to be conducted to demonstrate demand for such

[5] Symbian is a mobile operating system owned by Accenture PLC. The current Symbian OS version is exclusive to Nokia smartphones (Nokia, 2011).
[6] A cellular, reading machine developed by K–NFB Reading Technology, Inc. (Audio Optical Systems of Austin, Inc., 2009).

products. Telecommunications companies are aware of the need to provide accessible products, but there is no organized system providing assistive technology services on behalf of the private sector. In an attempt to reduce barriers to participation for consumers with disabilities several government agencies promote technology transfer[7] through telecommunications regulation.

Literature Review

Accessibility Regulation

American law has tried to keep pace with new technology. With the increased dependence on media access through smartphones, consumers who are blind or visually impaired may become a digitally disenfranchised group. In 1990, the Americans with Disabilities Act (ADA) was passed to prohibit discrimination based on disability. The Title III statute states that:

> No individual shall be discriminated against on the basis of disability in the full and equal enjoyment of the goods, services, facilities, privileges, advantages, or accommodations of any place of public accommodation by any person who owns, leases (or leases to), or operates a place of public accommodation. (Department of Justice, 1990)

A critical question has been raised on whether the ADA applies to the Internet and Internet supported devices. Private entities are considered public accommodations if their operations affect commerce. Undeniably, the Internet plays a large role in commerce, education, and employment and the device used to access the Internet constitutes a “place” of public accommodation, as covered under the law.

[7] Technology transfer is the process in which innovations are developed into practical and commercially relevant applications and products (Bain, & Leger, 1997).

The Department of Justice (DOJ) clarified what entities covered under the ADA are required to provide effective communication regardless of whether they generally communicate through print media, audio media, or the Internet. The DOJ has demonstrated consistency in upholding the rights of people with disabilities to access information provided on the Internet and has emphasized that electronic communication is subject to Title III. However, the provision does state that accommodations are expected as long as they are accomplished without much difficulty or expense to the entity.

The first major re-examination of telecommunications policy arose with the Telecommunications Act of 1996. The policies within the legislation promote the availability of telecommunications services and equipment to all consumers. Two provisions of the Act, Section 255 and Section 713, emphasize access for persons with disabilities. Section 255 requires all manufacturers of telecommunications equipment to design products that are readily accessible and usable by individuals with disabilities (Federal Communications Commission, 1996). Additionally, service providers are accountable for maintaining accessible phone networks. These requirements ensure that people with disabilities will have access to a broad range of phone products and service features. Section 713 sets requirements for the accessibility of video programming for individuals with hearing and vision impairments. This provision allows the Federal Communications Commission (FCC) to enforce closed captioning requirements for video programming. Section 713 also permits the FCC to investigate the use and widespread implementation of descriptive audio as a means to improve access for the visually impaired (Federal Communications Commission, 1996).

The Telecommunications Act of 1996 has enforced the accessibility of basic telephone service to the population of individuals with disabilities. It states that the FCC will encourage the accelerated deployment of advanced telecommunications services to all Americans by removing barriers to infrastructure investment (1996). Some critics argue that these provisions only apply to wired services. The application of these provisions to wireless devices and services has yet to be fully studied. And although Section 251(a)(2)(B) does prohibit telecommunication carriers from installing network features, functions, or capabilities which do not comply with access guidelines under Sections 255 and 256, for individuals with disabilities who need adaptive telephone equipment or software applications there is currently no solidified system with responsibility to ensure mobile access by these means.

The Social Model of Disability

The National Council on Disability and other independent agencies work to increase the inclusion and independence of all persons with disabilities. Numerous reports have been published in attempts to raise awareness about the need for narrowed legislation to promote digital equality. In an ideal climate, no person with a disability would be denied the opportunity to use the communication device of their choice because it is lacking the assistive features needed for operation. Social activists in turn are developing hypotheses to progress the field of disability theory.

Functionalist and interactionist theories have influenced the sociology of disability. Parsons suggested that at the onset of impairment individuals are involuntarily relieved of all social expectations and responsibilities (Parsons, 1951), while Goffman introduced the term “stigma” to identify the perceptions of the oppressor toward the

disabled (Goffman, 1963). Sociological interest in the area of disability almost exclusively stems from the ideas of people with disabilities themselves. The Union of the Physically Impaired Against Segregation (UPIAS), a collective of people with disabilities, share experiences and further the understanding of personal struggles through various publications. Collectively, the UPIAS came to the conclusion that disability was a form of social oppression (Barton, 1996). The UPIAS claimed a distinction between impairment and disability:

> In our view it is society which disables physically impaired people. Disability is something imposed on top of our impairments by the way we are unnecessarily isolated and excluded from full participation in society. (Union of the Physically Impaired Against Segregation, 1975)

British disability advocate, Mike Oliver, coined the term “social model of disability” in 1983 in reference to the ideological developments of the UPIAS (Oliver, 1990). This model proposes that negative attitudes and exclusion by society are the ultimate factors defining who is “disabled” and who is not in society.

Central to this model is the belief that individuals with disabilities have a right to access in society. The model identifies individuals with disabilities as experts on their own lives and as experts on disability; it does not necessarily see “difference” as a problem that needs to be fixed (Oliver, 1996). Therefore, the removal of barriers would improve the lives of people who are disabled, giving them the same opportunities as others on an equitable basis, despite differences. The social model emphasizes universal design and encourages people who are disabled to involve themselves in mainstream activities by raising awareness for policy-oriented accessibility issues.

The social model of disability is a progressive concept that makes an important distinction between the terms “impairment” and “disability.” Impairment exists in the physical world, while disability is a social construct imposed by people without impairments. The social model is not an all-encompassing theory of disability, but rather a starting point in reframing how society views disability.

Finkelstein’s discussion of disability and the economy builds on the social model by recognizing people with disabilities as stakeholders representing a large group of consumers, employees, and voters (Finkelstein, 1988). According to the United States Census Bureau 54 million people, or 20% of the population, identify with having some type of disability (McNeil, 2001). The economic empowerment of these individuals increases when family, friends, and employers are identified as additional stakeholders for the cause of equality. Due to the potential size of the demographic, companies and governments will accommodate needs pushed for by the cultural mainstream (Davis, 2006).

A major advance to the improvement of the social model was the 1992, special edition, publication of *Disability, Handicap and Society*. The journal included several articles that analyzed and challenged the current state of disability research. Oliver argued that research on disability has had minimal influence on policy and made no contribution to improving the lives of people with disabilities (Oliver, 1992). Barnes evaluates qualitative research[8] as a better data collection technique than quantitative research[9]. Barnes discussed his own experience with participant observation at several day centers for the disabled. Sixty-three, semi-structured field interviews were

[8] Observational method used to determine the in-depth motivations behind a subject’s decision making (Silverman, 2004).

[9] Statistical method used to analyze numerical data in order to provide generalized findings (Black, 1999).

conducted over a one-year period to compile biographies and discuss social participation. Banes found that qualitative research was only relevant if the researcher could set aside bias (Barnes, 1992). Zarb added that research should be subjected to critical scrutiny, in order to make researchers accountable to people who are disabled. Zarb developed four criteria for critical evaluation:

1) Who controls what the research will be about and how it will be carried out?
2) How far have we come in involving people with disabilities in the research process?
3) What opportunities exist for people with disabilities to criticize the research and influence future directions?
4) What happens to the results of the research?

Historically, people with disabilities and their representatives have been denied the opportunity to influence the agenda for disability research (Zarb, 1992). However, this study will apply the social model of disability to the uses and gratifications theory and the diffusion of innovations theory in order to expand disability research in the field of media.

Uses and Gratifications Theory

The field of communication research asked the question “What do media do to people?” But in 1959 Elihu Katz pioneered the question “What do people do with media?” This demonstrates the shift toward focusing on the purpose of communication for the receiver. The theory relies on the belief that the audience is not simply a group of passive consumers. Users seek media that best suit their needs, assuming that they have alternative choices to satisfy such needs. Uses and gratifications theory studies

the motives for media usage and the rewards that are sought. It suggests that certain factors work together to influence a consumer's media usage. McQuail, Blumler, and Brown (1972) categorized four "needs" that audiences seek to gratify. These needs included diversion from everyday routine and responsibilities, social interaction with friends and family, reinforcement of personal identity and values, and gathering of news and information.

The deregulation of the communications industry and the convergence of digital technology have increased media exposure for many consumers (Finn, 1997). As evolving technologies introduce new media choices, motivation and satisfaction become crucial components of audience analysis. Researchers have been applying uses and gratifications theory to new video media technologies (Ruggiero, 2000). The Internet has strengthened the applicability of uses and gratification theory because the medium requires a higher level of interactivity from its users in comparison to other traditional forms of media. The Internet is consumed intentionally since audiences must make purposeful choices about which sites to visit.

Researchers have examined the psychological and behavioral characteristics of Internet users in order to identify usage motivations (LaRose, Mastro, & Eastin, 2001). Korgaonkar and Wolin (1999) suggested that people use the Internet for retrieving information, seeking entertainment and escape. Lin (1999) identified the relationship between motivations behind Internet usage and the tendency toward online adoption. For example, information sites see the strongest effects due to surveillance motivations, whereas retail sites are most affected by entertainment motivations. Luo (2002) explored online consumer behaviors, such as usage and satisfaction. These studies

have demonstrated how uses and gratification theory has been an effective model in understanding the motivations and needs of Internet users.

Uses and gratifications research has explored the ways in which race, ethnicity, class, and gender affect media usage (LaRose, Mastro, & Eastin, 2001). However, more research is needed to identify the ways in which people with disabilities interact with media sources for information. For example, during the events of September 11, 2001, 28 million Americans with hearing or visual disabilities were unable to access public warnings and emergency communication messages because the infrastructure did not accommodate people with communication needs (Stout, Heppner, & Brick, 2004). This research in emergency preparedness for people with disabilities drew attention to the availability of assistive technologies, across several media distribution platforms, and the adoption among consumers. Surveys and interviews found that many individuals did not own mobile devices because they were difficult to use or too costly to own (p. 26).

Diffusion of Innovations Theory

Developed by Everett Rogers, diffusion research studies how innovations become known and are spread throughout a social system. Analysis is placed on the conditions that increase or decrease the likelihood of innovation adoption. Elements of research include the decision-making process and the characteristics of adopters (Rogers, 1995).

Rogers identified several characteristics of innovations that affect their rate of adoption. Relative advantage describes the degree to which an innovation is perceived as better than the current idea. Compatibility identifies the degree to which innovation is perceived as being consistent with the existing way of life. Complexability is the degree

to which an innovation is perceived as difficult to understand or use. Trialbility describes the degree to which an innovation may be experimented with on a limited basis. Finally, the past experiences and needs of potential adopters are examined (Rogers, 1995).

Personal innovativeness is another variable identified as influential on usefulness perceptions (Agarwal & Prasad, 1998). In general, highly innovative individuals are active information seekers of new ideas. They are able to cope with high levels of uncertainty, and usually lean towards acceptance (Rogers, 1995). Agarwal and Prasad (1998) defined personal innovativeness in the domain of information technology as the willingness of an individual to try out any new information technology. Individuals with a higher level of innovativeness with respect to information technology are expected to develop more positive perceptions about the innovation in terms of advantage, ease of use, and compatibility, and therefore have more use for new technologies. Rogers concludes by stating that the more complex a technology is perceived as being, the slower its rate of adoption will be (Rogers, 1995).

Looking specifically at technology adoption and mobile phones, several studies were found that applied technology adoption models to mobile phones or mobile phone features. Lee (2001) studied user acceptance of the mobile Internet and found that social influence significantly affected perceived usefulness and perceived ease of use. Pedersen studied the adoption behavior of early adopters of mobile commerce services (Pedersen, 2005). Kleijnen, Wetzels, and Ruyter (2004) investigated consumer acceptance of wireless finance and found that the variables of perceived cost, system quality, and social influence correlated significantly with attitude towards use. Kleijnen also found that age, computer skills, mobile technology readiness, and social influence

had effects on mobile usage. This study will examine how a consumer's impairment applies to technology adoption.

Significance of the Study

The application for this research can be utilized across several disciplines, including telecommunication regulation and disability theory. There is a recognized existence of the barriers and gaps in the current network of federal policy regarding assistive devices and services. For those with vision loss, this study aims to uncover attitudes regarding whether touchscreen technology acts as a barrier to mobile access by assessing the assistive design and software features of the most popular operating systems. This study also seeks to identify any usage misconceptions attributed to the lack of promotion toward the visually impaired demographic. In addition to commenting on the factors influencing technology adoption, this investigation will examine disability theories about social inclusion. Therefore, the following research questions will be investigated:

RQ 1: What is the state of consumer awareness and attitudes regarding built-in accessibility features for touchscreen smartphones?

RQ 2: What factors encourage the adoption of touchscreen smartphones among consumers with visual impairments?

The methods and procedures used to answer the above research questions are addressed in Chapter 2.

CHAPTER 2

METHODOLOGY

The research design focuses on the adoption of mobile touchscreen technology among consumers with visual disabilities. During a series of focus groups, questions were asked in order to identify the uses and gratifications that people with visual impairments had when using mobile phones. Additional questions were presented to determine if touchscreen technology limited access to communication and entertainment for users. The study aims to substantiate the need for national research in the regulation of assistive technology of mobile phones.

Research Design

Methodology in disability studies often follows the traditions of the emancipatory method,[10] a type of qualitative research, by assuming that people with disabilities are the experts on disability and that their active involvement in the research process is valued (Barnes, 2003). It is believed that their concerns best frame the questions that guide the research. Shakespeare (1996) gives insight into the rules by which a researcher conducts qualitative research. It is often in the best interest of the researcher to gently steer participants towards topics that are considered most relevant to the research purposes. The advantage to focus groups is that they could indicate how groups of people might react to a topic. Focus groups are a way to identify attitudes that reflect the individual's past experiences and current motivations. Consequently, the size and composition of the focus groups can draw attention to the differences and similarities among the participants.

[10] The emancipatory method is a collaborative effort among a group to actively discuss a problem and identify solutions (French & Swain, 1997).

The Institutional Review Board (IRB) at the University of North Texas gave approval for the focus groups for this thesis on May 26, 2011. Upon certification by the IRB the recruitment approach included collaborating with the Disability Accommodation Offices at the University of North Texas and the Office of Disability Support Services at Texas Women's University. Liaisons within these two offices agreed to forward an IRB approved recruitment letter, via email, to encourage participants who were visually impaired to sign up for a focus group.

The recruitment letter identified the focus group as an opportunity to voice opinions about touchscreen smartphones and their accessibility features. Potential participants were informed that the group would meet for 90 minutes and that snacks and refreshments would be served during the session. Mobility assistance was offered to participants that needed guides between campus buildings. Finally, the recruitment letter encouraged potential participants to invite other qualifying individuals.

The focus groups were held in a conference room at the University of North Texas campus on two consecutive days. The female focus group was held on August 30, 2011 and lasted 115 minutes. The male focus group was held on August 31, 2011 and lasted 90 minutes. The focus groups were moderated and transcribed by the author to ensure the privacy of the participants. At the beginning of each session participants were informed that the meeting would be audio recorded for transcription purposes. The consent form was read aloud and each participant signed a copy.

Participants

In these focus groups, a participant with visual impairment was defined as someone with blindness, moderate to severe visual acuity loss, or someone with loss in

their field of vision. Potential participants were asked if they had visual limitations that interfered with their daily living and if they used assistive technologies to complete daily tasks and activities. Participants were not required to own touchscreen smartphones in order to take part in the study, nor were they required to have used the accessibility features of their cellular phones. Varied experience with touchscreen smartphone design was favored because the study aimed to discover the depth of knowledge that participants had regarding built-in accessibility features.

These focus groups were not intended to be a representation of the population of all students; therefore, the group participants were selected by purposive sampling. Wimmer and Dominick (2006) describe a purposive sample as the method by which subjects have been selected based on specific characteristics. Several of the participants were located based on snowball sampling because friends and family members who had responded to the recruitment letter forwarded the focus group invitation.

Ten individuals participated in the two focus groups: five females and five males. The focus groups were purposely divided by gender to encourage an atmosphere of familiarity among the participants. The demographic was set to men and women between 18-35 years of age, but one participant who exceeded the age limit was permitted to join a focus group because of his status as an undergraduate student. Of the participants, three females and five males were undergraduate students from the University of North Texas, one female was a graduate of the University of North Texas, and one female was a graduate of Texas Women's University. All participants identified themselves of having severe visual impairment and limited field of vision. This study did

not claim validity as being a representative sample of smartphone users with visual impairment. It was designed as a preliminary study to evaluate the potential of measuring smartphone usage and attitudes among visually impaired consumers.

Focus Group Questions

The goal of the focus groups was to allow respondents to communicate and explain, in-depth, any reservations they have about touchscreen technology on smartphones. Additionally, the line of questioning probed for discussion about inclusion and other topics of disability theory. Focus group questions were decided beforehand to emphasize the direction of the conversation. Prepared questions included:

1. Do you own a cellular phone?
    a. If not, please explain why you do not use a cellular phone.
    b. If so, what brand? Is your phone considered a ‘smartphone’?
2. What do you use your cellular phone for the most?
3. How often do you access the Internet from your cellular phone? What sites do you visit?
4. Please estimate how many people you know that own touchscreen smartphones?
5. Have you ever tried using a touchscreen smartphone? Describe the experience.
6. Have you thought about upgrading to a touchscreen smartphone? Why or why not?
7. What do you know about the accessibility features of touchscreen smartphones?

8. What would you change about the accessibility features of touchscreen smartphones?
9. Has anyone offered to setup or customize a touchscreen smartphone for you?

This line of questioning was used to identify trends in the participants' mobile access and adoption of newer technology. Several of the questions were open-ended and required the individuals to explain specific experiences. This prompted the conversation to flow freely and encourage contribution. A detailed account of the investigational findings observed during each focus group is provided in Chapter 3.

CHAPTER 3

RESULTS

The two focus groups used in this study were divided by gender. Five females attended the first session and five males provided responses for the second focus group. Below are the results to the questions presented to each group.

Female Focus Group

All five of the female participants identified themselves as being legally blind and two of the participants were cane users. All of the participants explained that there was no treatment or cure in their specific cases. Their cases of vision loss included three females with retinitis pigmentosa, one female with cone and rod dystrophy, and one female with an undeveloped optic nerve. Retinitis pigmentosa was explained as being a genetic condition where progressive vision loss results in night blindness, tunnel vision, and the possibility of complete vision loss. Another female explained her cone and rod dystrophy as an inherited disorder that causes progressive vision loss and sensitivity to light. Finally, the female with an undeveloped optic nerve described her vision loss as a birth defect that left her with no vision in one eye.

To begin, the focus group participants were asked if they owned a smartphone, what brand the phone was, and if the phone had a touchscreen display. Three of the female participants owned an iPhone, one female owned an Android OS touchscreen phone with a physical keyboard, and one female owned a non-touchscreen Motorola smartphone that runs on the Brew OS[11]. Regarding their previous experience with smartphones, the touchscreen owners all confirmed that this was their first touchscreen

[11] A mobile platform created by the telecommunication corporation Qualcomm.

device. When discussing relative advantage many of the participants felt that their peers spoke highly of the accessibility of touchscreen phones. One participant explained, “I began to talk to other blind and vision impaired users who really loved it and I thought if they can use it and love it, so can I. That’s what made me try it.” Another participant agreed, “Quite a few friends have iPhones and iPad. I’ve played around with it and I could figure it out pretty fast.” One participant disagreed on the appeal of iPhones, “The lack of buttons drives me crazy. I really need the buttons. I don’t know how half the blind people do it. It’s too complex.” Another interjected, “But I’m wondering how many of them are braille readers and for how long. I wonder if the people who can pick it up and really like it aren’t braille literate.” Of the five female participants only two considered themselves proficient in braille. A participant agreed, “Yeah, I’m tacitly oriented. That would be a hurdle to overcome with a phone that was only touchscreen.” Some of the other participants discussed amongst themselves the different brands of cellular phones that utilized touchscreen design and a QWERTY keyboard.

One participant explained the reason she didn’t have a touchscreen as being the fact that certain phones were on carriers that she couldn’t afford. “Verizon has nice phones, but I don’t think I could pull off the price of Verizon’s service.” The topic of price was consistently mentioned during the session. Participants were concerned about the price of cellular phones and the cost of accessibility applications. “One person told me about Mobile Speak for Nokia phones, but that would cost me $400. Why pay that when I could upgrade to an iPhone for $50. Price is always an issue, especially for people who live off of Supplemental Security Income[12].” Participants then began to discuss the

[12] Supplemental Security Income is a government stipend for income-restricted individuals who are blind, disabled, or elderly.

value of the iPhone's accessibility features compared to more expensive accessibility software. "It's not perfect on the iPhone, I see some things where the Mobile Speak was better, but with the price difference you can't complain." Another female agreed, "It might be cheaper, but it's not necessarily better."

Participants agreed that people with visual impairments would probably prefer a touchscreen phone that also utilized a physical keyboard. When asked about what design changes should be made, one participant reflected on how using an all touchscreen phone can be difficult in certain environments when you don't have a physical keyboard. "If I'm in the house I'm fine, I can change the contrast on it. If I'm in the car that makes it harder because you're bumping around and the car is moving." Another participant responded with an anecdote on the importance of customizing the accessibility settings. "My iPhone is set to read text messages aloud as I receive them. Even when I'm on the phone talking to someone the message will read aloud. If I'm on a business call I just ignore it and pretend it didn't happen. It's an opportunity to be embarrassed." Regardless of the issues mentioned, all three of the iPhone owners said that they have recommended the iPhone to others who have visual impairments.

The female participants also discussed the motivation required in searching for the best smartphone. "A lot of times the sales associates just don't know a lot about assistive settings." Another participant agreed, "You have to go to the store knowing what you want. I asked a lot of other visual impaired people for their opinions and I read a lot of blogs, because I couldn't get the information I needed anywhere else." With regard to customizing the accessibility settings most of the participants asked family members and friends for help. One participant explained further, "It depends on the

individual themselves, whether they are independent and if they want to learn on their own. I know a blind female that was able to use the iPhone right out of the box. Not me, I needed to get the basics down before I could move on." One participant explained that she spent her time reading the manual. "But the manual wasn't very adequate. Audio instructions would have been great. But that would cost more and people don't want to take away from the bottom line." Another participant added, "That's why it's going to take a while for legislation to catch-up with accounting for the visually impaired community with touchscreen technology."

The conversation steered toward the specific accessibility features that the participants liked about their cellular phones. All of the female participants used their smartphones mostly for phone calls and several of them used the voice command option to dial the contacts saved to their phones. Text messaging was also a popular activity among the participants, but one individual expressed a limitation that she encountered with her Motorola phone. "I do text, but I can't read what people send back to me. So I mostly use text to send messages about my location or if I'm running late." Regarding the Internet, four of the participants consistently visited Facebook and other websites on their phones, "I use Facebook's mobile site, and since it's in HTML my screen reader can read the text back to me." One participant that didn't use the Internet on her iPhone explained, "My iPhone has Internet but I can't see it, I don't think I can use the magnification setting at the same time as the text-to-speech application." The participants noticed that even though several of them had the same phone their experiences with the accessibility settings were different.

Participants then reflected on instances when they have encountered touchscreen design in social settings. The female participants began to discuss the experience of using touchscreens at the grocery store. One participant explained, “I find it very frustrating because I don’t feel that I’m entering my pin securely. If I’m alone I need the store clerk to help.” Another participant added, “I find that a little powerless. With the nature of a visual impairment you already feel powerless, but you really want as much independence as you can.” Several participants questioned if touchscreens would become the dominate design, but one individual answered back, “I suspect if this is where technology is going they’re going to have to account for us, until then we’re caught in the middle.”

One female stressed the importance of utilizing available resources. “Usually if you’re visually impaired you’re connected enough to where you have resources available to you, and beyond that you just have to dig a little bit further.” One participant acknowledged that some individuals lack advocacy, “It’s harder for people with visual impairments who do not receive the services they need.” She continued, “Unfortunately, it seems like the poor and minorities and people with disabilities are usually the ones that get kicked first because they don’t have as much power.” All of the females endorsed the state services for the blind, but wondered what impact budget cuts would have on those services. One female participant shared, “The Division of Assistive Rehabilitation Services and the Division of Blind Services helps with teaching braille and even the acquisition of assistive technology.” Another participant mentioned that she was a client of the Texas Commission for the Blind, an organization that keeps her updated on news and services.

Finally, the females discussed their opinions on equality. “There’s a difference in equality and equity. A lot of things are accessible but don’t provide equity and I think it will take time for more options to become available for visually impaired people.” When asked to explain further the participant stated, “For instance, a ramp is accessible to someone in a wheelchair, but if there is only one entrance with a ramp that’s not equity. Equality is being able to get into the building, but equity would be having the option to use any entrance.” The participants explained that they subscribed to the Independent Living Movement of “nothing about us without us,” insisting that the most valuable research information comes from the visually impaired themselves. “If someone has a question they should ask, because they don’t know what it’s like to be in our place.”

Male Focus Group

All five of the male participants identified themselves as being legally blind and four of the participants were cane users. All of the participants explained that there was no treatment or cure in their specific cases. Their cases of vision loss included two males with retinitis pigmentosa, one male with a tumor on the optic nerve, and two males with Leber’s congenital amaurosis. The males with retinitis pigmentosa explained their circumstance as progressive vision loss due to the degeneration of the retina. They both described their sight as tunnel vision. Another male described the tumor on his optic nerve as causing loss of peripheral vision and distance vision. Finally, the two males with Leber’s congenital amaurosis defined the eye disease as an inherited recessive trait that causes vision loss and light sensitivity.

The focus group participants were first asked if they owned a smartphone, what brand the phone was, and if the phone had a touchscreen display. Four of the male

participants owned an Android OS touchscreen phone, three of which had physical keyboards. One male owned a touchscreen phone from LG Corp. that also had a physical keyboard. Regarding their previous experiences with smartphones, all of the participants confirmed that this was their first touchscreen device.

Two participants revealed that they prefer keyboards, even though their devices had touchscreens. One male stated, “Usually, I stick with the keyboard. But Android does have some built-in features; you can set it to where if you swipe your finger in one direction the phone will tell you the time. That’s really all I ever use the touchscreen for.” One participant agreed, “I like having the option to use the screen or the keyboard, but I prefer the keyboard.” Another participant disagreed and stated that he preferred the larger screen his phone had because it did not have a keyboard. “On a phone I have to get within 6 inches to the screen. So I like a bigger screen. Bigger is easier.” The debate continued on whether exclusively touchscreen phones were practical. One participant explained, “I haven’t drunk the iPhone Kool-Aid. I’ve heard a lot of people say that it was fine, you get used to it, but I like having buttons. I’ve avoided the iPhone.” Another participant agreed, “I’m sticking with Android as long as I possibly can, I couldn’t figure out the iPhone.”

The majority of the respondents expressed their reliance on tactile feedback. Of the five male participants only one had no experience with braille, “I hope I don’t have to learn braille. My vision loss has remained stable for many years, so as long as it doesn’t change I won’t have to learn.” The group was split on whether or not braille would become an obsolete reading system. Another explained that he felt it was important to learn braille because he would inevitably lose all of his vision. The same participant

reiterated that it's important to know the braille system as well as expanding his knowledge of the assistive technologies available. "There's so much technology. The world continuously advances and if you're going to be a part of society you have to advance with it, it's natural instinct."

Customization proved to be an important feature for several of the male participants. One male claimed that he purchased his specific phone because of the options for customization. "It didn't have the accessibility features that I liked. I rather have a good magnification application instead of a text-to-speech application, so I just downloaded the things that I wanted." A different participant explained the events leading up to his smartphone purchase, "The majority is word of mouth. You'll talk to someone who has something, then you research it, and if you like it you buy it. The male participants did not identify pricing as the most important factor in their purchasing decisions for phones and software.

All of the male participants said that they used their smartphones mostly for text messaging, GPS navigation, taking pictures, and Internet surfing. But one expressed difficulty with the size of the Internet browser on his particular phone, "I'd like to get on the Internet, but the screen is too small. I need one of you guys to help me set it up." When asked about getting assistance from others to customize their smartphones one participants claimed that cell phone representatives don't have much experience working with the blind. He went on to explain that sale representatives could be characterized as not fully understanding the functions of accessibility features, but having enough knowledge to help the customer navigate through the menus in order to change a setting. "A lot of people will think you have more vision than you do, especially

if you don't really look blind." Another participant agreed, "Yeah, when you meet people they actually think you're joking about your vision loss and they can be insensitive about your needs. But it's mostly good intentioned ignorance."

Finally, the male participants addressed the similarities amongst themselves. "It's amazing how different our backgrounds are, but how similar we are now with our reliance on technology." One participant agreed, "No matter the vision conditions all of our experiences seem to overlap." Another participant voiced that he dealt with insecurities, "It can be difficult to socialize, because people can be inconsiderate and tend to adopt stereotypes." Several of the males agreed and mentioned stories of bullying and discrimination. "There's ignorance on both sides since there isn't a lot of dialog."

Summary

The responses propose an upward trend in touchscreen smartphone adoption among the participants. The female and male participants all agreed on the relative advantage of touchscreen smartphones, expressing that the touchscreen smartphones they owned offered basic assistive features. Both groups stated that their cell phone usage revolved mostly around text messaging and Internet surfing. Yet, the two groups demonstrated differences in touchscreen usage since the female participants relied heavily on the touchscreen display and the male participants relied mostly on the physical keyboard when navigating the features on their smartphones.

All participants seemed to make adoption decisions based on input from family and friends. However the majority of females appeared to be more attracted to popular brand names, such as the iPhone, and found value and cost effectiveness within a

phone's practically and ease of use. Additionally, the females expressed their desire to learn the basics of the assistive technology and were adamant about the standardization of features, rather than customization. Instead, males seemed to dismiss brand recognition as a factor in the purchasing decision and appeared to be more comfortable with exploring the assistive features and downloading additional applications to better customize their experience with the touchscreen technology. An in depth analysis of these results and suggestions for further study are discussed in Chapter 4.

CHAPTER 4

DISCUSSION

This thesis asked whether or not consumers with vision loss chose to adopt touchscreen smartphones outfitted with assistive software features. Based on the results this study concluded that the use of touchscreens in smartphone design did not hinder adoption among the focus group participants. Participants agreed on the usefulness of technology convergence, especially with regards to the mobile platform.

The first research question asked “What is the state of consumer awareness and attitudes regarding built-in accessibility features for touchscreen smartphones?”

Participants had identified specific accessibility settings and downloadable applications that they considered useful while navigating their touchscreen phone. Participants also demonstrated knowledge of the assistive features for various brands of cellular phones that they had never owned. Participants attributed their knowledge to hours of research and the ability to trial smartphone brands owned by family members and friends. When discussing specific brands and interfaces, attitudes toward touchscreen technology ranged from neutral to favorable. Negative attitudes were not necessarily geared toward touchscreen technology specifically, but rather towards devices that did not incorporate the most common accessibility features.

The second research question asked “What factors encourage the adoption of touchscreen smartphones among consumers with visual impairments?”

Motivations established by the uses and gratification theory and diffusion of innovation theory coincided with the information collected during the two focus groups. The results of the study revealed that consumers with varying ranges of vision loss do

purchase touchscreen smartphones. This could be interpreted as predicting an upward trend in adoption among this group of consumers based on the observation that nine of the ten participants owned a smartphone with touchscreen capabilities.

Concerning the uses and gratifications theory, the majority of participants felt that touchscreens were not a frustrating design that prevented them from their favorite diversions. Both female and male participants noted that many of the entertainment applications for music and social media were compatible with the installed or upgraded text-to-speech readers. But social integration seemed to be the foremost gratification among the female and male participants. Constantly being able to communicate with friends and family, in real time, was an occurrence that several participants had never experienced before. Additionally, users felt more informed about recent events since news stories and alerts were easily obtainable. This also contributed to personal value reinforcement, as participants agreed that accessibility features on touchscreen smartphones attributed to confident attitudes when exploring newer technologies.

Regarding diffusion of innovations theory, the factors for adoption based on compatibility, complexability, trailability, and past experiences, were all considered by the participants before their smartphone purchase. These factors seemed to have the most impact on the specific design purchased among touchscreen phones with keyboards or without keyboards. None of the participants claimed that touchscreen smartphones, in general, were too complex or too difficult to use. However, the respondents recognized that it was possible for certain users to become frustrated with the lack of tactile buttons on an exclusively touchscreen phone. For some users compatibility meant the incorporation of a physical keyboard because the tactile design

represented a familiar and comfortable feature. This was demonstrated in the responses from the male participants stating that they relied on both the physical keyboard and touchscreen display. Trialability was an important adoption factor because the accessibility to different models from friends and family members, in conjunction with online research and visits to cellular phone dealers, allowed the majority of participants to quickly develop an opinion towards a specific design and brand of phone. Finally, when discussing users' past experiences with cellular phones the majority of participants explained that older phone models did not have justifiable costs. The female participants in particular were more willing to accept certain shortfalls of touchscreen design in order to have a phone that utilized free or cheaper accessibility bundles.

The focus group participants demonstrated that they were not passive consumers, as personal innovativeness appeared to have the biggest impact on the type of accessibility applications used. But as Kleijnen (2004) discussed, age and computer skills had an impact on the tech readiness of the participants. For example, the two oldest participants exhibited less knowledge regarding the types of applications that were available to them and how they could set up the equipment themselves. But, those two participants confirmed having interest in learning from the younger participants.

Contributions of the Study

This investigation is the first qualitative study to examine the barriers to mobile access for smartphone users with visual impairment. By answering Zarb's (1992) critical evaluation questions this project demonstrated that investigations are not being done.

This would suggest the lack of unified network of smartphone users with visual impairments. Although rehabilitative agencies were considered useful for obtaining specifications about various assistive products, most users gathered information and made purchasing decisions on recommendations from friends and family.

The primary contribution of this study is encouraging dialog between the community of visually impaired cellular phone users, device manufactures, and policy makers in order to substantiate the need for national research in the regulation of assistive technology of mobile phones. Current regulations do not require cellular phones to be accessible to users with disabilities. Additionally, Internet sites accessed over mobile phones are also not required to be accessible.

By holding the focus groups the investigation tried to establish the usage of touchscreen technology and the demand for more accessible and compatible applications. Additional research would increase awareness of accessibility limitations and promote an in depth examination into the current telecommunication laws. A possible solution might be that if device design is not going to be standardized with basic built-in accessibility then at least all devices should be required to be customizable and compatible with downloadable applications. Further investigation would possibly encourage device manufactures to acknowledge that cost effective measures can be taken to promote the right to access.

Suggestions for Future Research

As an exploratory study, this project would benefit from methodology that emphasized participant recruitment. By expanding the participant search to adults past the 18-35 age demographic might demonstrate a generational divide in opinions and

usage of touchscreen smartphones. Additionally, categorizing the focus group participants by various characteristics such as age, gender, education, and background might better demonstrate the similarities and/or differences in purchasing motivations among the participants. A coded research component, in the form of a survey, could help to categorize such characteristics. This empirical data would reveal adoption patterns among similar users. This will also increase the validity of the research conclusions by considering if the qualitative results can explain the quantitative data and vice versa.

Limitations

Although the focus group atmosphere encouraged dialogue among peers, some interested individuals were not able to participate because of lack of transportation. Most of the participants required a friend or family member to drive them to the location and several respondents that lived within walking distance explained they felt uncomfortable traveling to an unfamiliar part of campus without a chaperone. A number of individuals, who confirmed their participation but ultimately did not attend the focus groups, later explained that traveling to the building alone presented challenges and became a hassle. If the methodology design was an individual interview format instead of the focus group format it is assumed that more respondents would have participated.

Conclusion

The principal conclusion drawn from this study is the substantial number of participants who owned a touchscreen smartphone. As reported in the results, nine of the ten participants owned a touchscreen smartphone and the participant that did not own a touchscreen phone was essentially due to the cost of cellular phone plans. The

data gathered also indicates that current touchscreen smartphone design encourages the customization, rather than the standardization, of assistive technologies. This is demonstrated in the extensive variety of smartphone brands, designs, and features. This was also confirmed by the focus groups which established that individuals with the same touchscreen smartphone were using the built-in assistive features differently.

This study has drawn attention to the factors affecting the purchasing process for these consumers. People with visual impairments often spend significant amounts of time searching for accessible cellular phones, yet still encounter setbacks regarding the accessibility of touchscreen design. Raising awareness of these issues could lead to more user-friendly assistive technologies on mobile devices and increase the discussion of inclusion across several disciplines and industries.

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