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**Tactile Media: Factors Affecting  
the Adoption of Touchscreen  
Smartphones among Consumers  
with Vision Loss**

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## **Tactile Media: Factors Affecting the Adoption of Touchscreen Smartphones among Consumers with Vision Loss**

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### **Abstract**

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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## ***Introduction***

Traditional forms of media, such as television, radio, and newspapers are taking on new platforms of distribution. 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 have become streamlined in design as the human capacity toward multitasking leads to innovations in user interfaces, such as 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. However, the usability of the touchscreen device would be lost on any consumer that lacks the physical ability to operate the device. There is no trackball to act as a tangible point of reference and the tactile QWERTY<sup>1</sup> keyboard, with texturized keys, is also missing. This study asks whether or not consumers with varying ranges of vision loss choose to adopt touchscreen smartphones<sup>2</sup> outfitted with assistive software features and investigates the attitudes this consumer group has with regards to the theory of inclusion in a mobile media society.

## **Background**

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. 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. Section 255 of the Act requires all manufacturers of telecommunications equipment to design products that are readily accessible and usable by individuals with disabilities. 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 (Federal Communications Commission, 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 which do not comply with access guidelines, for individuals with disabilities who need adaptive telephone equipment and software applications there is currently no solidified system with responsibility to ensure mobile access by these means. In order to increase the telecommunications sector's investment in accessibility features more research needs to be conducted to demonstrate demand for such products.

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<sup>1</sup> The most common keyboard layout used for American computers and mobile devices.

<sup>2</sup> 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.

Display manufacturers worldwide have acknowledged the upward trend in touchscreen 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<sup>1</sup> (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. 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).

### *Assistive Technology*

The National Council on Disability (2000) defines assistive technology as any product or system, 'whether 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<sup>2</sup>. 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. Although there are numerous downloadable applications, some mobile platforms simply lack compatibility. For example, 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).

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<sup>1</sup> As of December 2011, stock in RIM dropped by 77% due to continuous market share losses to iPhone and Android phones (Miller, 2011).

<sup>2</sup> Universal design is a principle that advocates the operability and simplicity of products for all users (Lidwell, Holden, Butler, & Elam, 2010).

*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.

British disability advocate, Mike Oliver, coined the term ‘social model of disability’ in 1983 in reference to the ideological developments of the Union of the Physically Impaired Against Segregation (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. 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. Central to this model is the belief that individuals with disabilities have a right to access in society. 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).

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?

**Methodology**

Methodology in disability studies often follows the traditions of the emancipatory method,<sup>1</sup> a type of qualitative research, by assuming that people with disabilities are

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<sup>1</sup> The emancipatory method is a collaborative effort among a group to actively discuss a problem and identify solutions (French & Swain, 1997).

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. Upon certification by the Institutional Review Board 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. Ten individuals participated in two focus groups that were purposely divided by gender. The group participants were selected by purposive and snowball sampling. These focus groups were not intended to be a representation of the population of all students and the study did not claim validity as being a representative sample of smartphone users with visual impairment. The study was designed as a preliminary investigation to evaluate the potential of measuring smartphone usage and attitudes among visually impaired consumers. 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.

## Results

### *Female Focus Group*

All five of the female participants identified themselves as being legally blind. 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. 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<sup>1</sup>. Regarding their previous experience with smartphones, the touchscreen owners all confirmed that this was their first touchscreen 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.' However, one participant disagreed on the appeal of iPhones, 'The lack of buttons drives me crazy. 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.'

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<sup>1</sup> A mobile platform created by the telecommunication corporation Qualcomm.

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.' Regardless of any issues mentioned, all three of the iPhone owners said that they have recommended the iPhone to others who have visual impairments.

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.' Participants then began to discuss the 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.'

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.' One participant explained further, 'It depends on the individual themselves, whether they are independent and if they want to learn on their own.' 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.' 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.'

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.

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. 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 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’ve avoided the iPhone. I’ve heard a lot of people say that it was fine, you get used to it, but I like having buttons.’ 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. But one participant insisted, ‘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.' When asked about getting assistance from others to customize their smartphones one participant claimed that cell phone representatives don't have much experience working with the blind. He went on to explain that sales 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.' Another participant agreed, 'Yeah, but it's mostly good intentioned ignorance. There's ignorance on both sides since there isn't a lot of dialog.'

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.' Another participant agreed, 'No matter the vision conditions all of our experiences seem to overlap.'

### *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 practicality 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.

### **Discussion**

This study asked whether or not consumers with vision loss chose to adopt touchscreen smartphones outfitted with assistive software features. Based on the results, this investigation 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. 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?' 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 uses and gratifications, 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 and news stories. This also contributed to personal value reinforcement, as participants agreed that accessibility features on touchscreen smartphones attributed to confident attitudes when exploring newer technologies.

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.

### *Suggestions for Future Research*

As an exploratory study, this project would benefit from methodology that emphasized categorizing the focus group participants by various characteristics such as age, education, and background might better demonstrate the similarities and/or differences in purchasing motivations among the participants. 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.

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. But further investigation would possibly encourage device manufactures to acknowledge that cost effective measures can be taken to promote the right to access.

### *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.

### **References**

- ABI Research. (2008). 'Touch screens in mobile devices to deliver \$5 billion next year.' Available at [http://www.abiresearch.com/press/1231Touch+Screens+in+Mobile+Devices+to+Deliver+\\$5+Billion+Next+Year](http://www.abiresearch.com/press/1231Touch+Screens+in+Mobile+Devices+to+Deliver+$5+Billion+Next+Year) [25 January 2010].
- Apple, Inc. (2010). 'Apple - accessibility - iPhone - vision'. Available at <http://www.apple.com/accessibility/iphone/vision.html> [ 25 January 2010].
- Barnes, C. (2003). 'What a difference a decade makes: Reflections on doing emancipatory disability research.' *Disability and Society* 18(1): 3-17.

- Brewster, S., Hoggan, E., & Johnston, J. (2008). 'Investigating the effectiveness of tactile feedback for mobile touchscreens.' *Proceedings of the ACM* (pp. 1573-1582). Addison Wesley: ACM Press.
- Bridges, E. (2010). 'State of accessibility for mobile phone devices for people who are blind, deaf blind or who have low vision (DA 10-1324).' Arlington, VA: American Council of the Blind.
- Davis, L. (2006). *The disability studies reader*. New York, NY: Routledge.
- Federal Communications Commission. (1996). 'Telecommunications Act of 1996 (No. 104-104).' Available at <http://www.fcc.gov/Reports/tcom1996.pdf> [20 January 2010].
- Finkelstein, V. (1988). *Attitudes and disabled people: Issues for discussion*. New York, NY: World Rehabilitation Fund.
- French, S., & Swain, J. (1997). 'Changing disability research: Participatory and emancipatory research with disabled people.' *Physiotherapy*, 83(1): 26-32.
- Kleijnen, M., Wetzels, M. & Ruyter K. (2004). 'Consumer acceptance of wireless finance.' *Journal of Financial Services Marketing*, 8(3): 206-217.
- Lidwell, W., Holden, K., Butler, J., & Elam, K. (2010). *Universal principles of design: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design*. Beverly, MA: Rockport Publishers.
- McNeil, J., (2001). 'Americans with disabilities.' *Current Population Reports: Household Studies*, (70-73).
- Miller, H. (2011). 'RIM shares tumble on delayed blackberry.' Available at <http://mobile.bloomberg.com/news/2011-12-15/rimforecast-misses-analyst-estimates?category=%2Fnews%2Ftechnology%2F> [19 January 2012].
- National Council on Disability. (2000). 'Federal policy barriers to assistive technology.' Washington, DC: Government Printing Office.
- Oliver, M. (1990). 'The individual and social models of disability.' *Proceedings of the living options group*, Available at <http://www.leeds.ac.uk/disabilitystudies/archiveuk/Oliver/in%20soc%20dis.pdf> [3 December 2010].