Use of Mobile Phones by Individuals with Visual Impairments

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INTRODUCTION

Mobile phones have been commercially available only for three decades but they are now indispensable for many. A great majority of mobile phones available in shops are designed with a preconception that the user will have good visual and auditory abilities. However, this is not the case for people with visual or auditory impairments. This article focuses on the issues of accessibility of mobile phones by individuals who are blind or visually impaired, assistive technologies, and design guidelines. For the sake of simplicity, the term individuals with visual impairments (IVI) will also include blind individuals.

Blindness is defined as visual acuity worse than 3/60, 1/20 (0.05), or 20/400 or no light perception (WHO, 2010). Here, visual acuity refers to the ability to see clearly, in standard Snellen notation. The first number in the fraction 3/60, for example, indicates that the distance at which the person can see clearly a specific print is 3 feet (0.9 m). The second number indicates that a normally sighted person can see the same print at 60 feet (18.3 m). A vision of 20/400 shows that the person is only able to see the largest letter (the big E in the Snellen chart) at 20 feet (6.1 m), whereas someone with normal vision can see the same letter E at 400 feet (121.9 m). Severe visual impairment is defined as visual acuity worse than 6/60, 1/10 (0.1), or 20/200 and equal or better than 3/60, 1/20 (0.05), or 20/400. Moderate visual impairment is defined as visual acuity worse than 6/18, 3/10 (0.3), or 20/70 and equal or better than 6/60, 1/10 (0.1), or 20/200 (Sardegna et al., 2002).

A critical issue in the use of mobile phones and any type of technology-driven product is accessibility. *Accessibility* is the usability of a device by the broadest possible population within the broadest possible range of environmental conditions. Accessibility with regard to telecommunication products such as mobile phones, portable computers, and pagers, implies that such products are readily obtainable for individuals with disabilities without added expense and that they do not pose extreme difficulty in such operations as input, device control, and output (Smith-Jackson, 2003). Many issues under accessibility can be grouped under the term *usability*. The five main features of usability were listed as (Nielsen, 1992; Smith-Jackson et al., 2003):

- Ease of learning;
- Efficiency;
- Memorability (easy to remember procedures);
- Low error rates;
- Satisfaction.

Ideally, an IVI should be able to learn the use of a mobile phone easily and independently, use it efficiently, remember what to do easily in order to make or answer a call/write or receive a message, make zero or a small number of errors during operation, and be pleased by the product. If any of these conditions are not satisfied, the usability and accessibility of the mobile phone would be considered to be low by the user.

Mobile phones with low accessibility are commonly adapted by individuals with disabilities

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according to their own needs. *Adoption* in this context means both the acceptance of mobile phones and their transformation for easier use. Some adoption strategies include modifying a mobile phone, adapting to it, using multiple devices, and learning the use of the device offline (Kane et al., 2009).

While several adoption methods may be needed under different circumstances, researchers and industrial firms are constantly searching for means of improving the accessibility of mobile phones by compensating or alleviating the effects of visual impairment and other disabilities. Such solutions include products, devices, technical systems, and software and are known as *assistive technologies* (Johnsen et al., 2012).

OVERVIEW

According to recent statistics, 285 million people worldwide suffer from some type of visual impairment. 39 million are blind and the remaining 246 million have low vision (WHO, 2014).

Vision loss and blindness are also common problems related to aging. European countries, Japan, Australia, and Canada have a population with a higher life expectancy compared to less developed countries such as Sierra Leone, Central African Republic, and Democratic Republic of the Congo (WHO, 2013). Combined with an aging population, a higher life expectancy usually means a larger number of adults with vision loss. For example, 20% of the UK population aged over 75 is reported to live with sight loss (Hakobyan, 2013). Age related macular degeneration, cataract, and glaucoma are some of the leading causes of vision loss in adults (Kocur and Resnikoff, 2002). The frequency of blindness increased from 0.1% in the age group 55-64 to 3.9% in the age group 85 and above in a study conducted in the Netherlands (Klaver et al., 1998). Thus, many design improvements aimed at increasing accessibility for IVI may also be beneficial for elderly mobile phone users.

After its commercialization, the telephone has always been an important communication device for IVI because it increased the speed and frequency of social or professional interaction. The classical rotary dial telephone used until the 1970s and the push-button or touch-tone phones that superseded them were easier to use by IVI compared to contemporary mobile phones. Two important challenges faced by IVI when using a touch-tone telephone are to dial and record phone numbers. However, these are relatively easy to overcome. For example, it is possible to remember the position of each number on the keypad and most of the keypads have a raised dot or so-called tactile indicator on the number 5. Self-adhesive raised dots are also available which may be used to facilitate correct dialing (Ponchilia, 1996; Presley and D'Andrea, 2008). It is interesting to note that in a phone survey conducted with IVI in Turkey, a large percentage (38%) of 144 employed participants have been working as switchboard operators (Bengisu et al., 2008) which demonstrates that IVI are fully capable of overcoming challenges related to telephones and more complicated telecommunication systems.

There are some alternatives to dialing which may be available depending on the local telephone company or product technology offered by a certain telephone brand. These alternatives include voice-input (or voice activated) telephones, speed dialing, and programmable phones (Ponchilia, 1996). Voice activated telephones allow someone to make a call by clearly telling the name of a person or place whose number has been recorded previously. Speed dialing is a service provided by some local phone companies for a monthly charge. The user is required to predefine the numbers which will be dialed frequently and pair them with short speed dialing codes such as the star key or a two-digit number. Many touch-tone telephones today provide the option to program several phone numbers by using the regular keypad or additional keys reserved for this purpose. As in the case of speed dialing, the user needs to match a simple code with the desired number which is