

## Chapter 31

# Towards Multimodal Mobile GIS for the Elderly

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### ABSTRACT

*Information technology can play an important role in helping the elderly to live full, healthy and independent lives. However, elders are often overlooked as a potential user group of many technologies. In particular, we are concerned with the lack of GIS applications which might be useful to the elderly population. The main underlying reasons which make it difficult to design usable applications for elders are threefold. The first concerns a lack of digital literacy within this cohort, the second involves physical and cognitive age-related impairments while the third involves a lack of knowledge on improving usability in interactive geovisualisation and spatial systems. As such, in this chapter we analyse existing literature in the fields of mobile multimodal interfaces with emphasis on GIS and the specific requirements of the elderly in relation to the use of such technologies. We also examine the potential benefits that the elderly could gain through using such technology, as well as the shortcomings that current systems have, with the aim to ensure full potential for this diverse, user group. In particular, we identify specific requirements for the design of multimodal GIS through a usage example of a system we have developed. Such a system produced very good evaluation results in terms of usability and effectiveness when tested by a different user group. However, a number of changes are necessary to ensure usability and acceptability by an elderly cohort. A discussion of these concludes the chapter.*

DOI: 10.4018/978-1-4666-1852-7.ch031

## INTRODUCTION

New information technology (ICT) can play a very important role in the quality of life of elderly people who wish to continue living autonomously as they age. For example, mobile phones enable people to stay connected, in addition to hosting services such as location-based applications that aid people navigating and locating points of interest. Furthermore, using such applications encourages cognitive activity among its users, which is important in keeping an active mind. However, technology, particularly mobile technology, can be difficult for elderly users to accept and adopt for a number of reasons. Firstly, the vast majority of the current, and near future, elderly cohort are not digitally literate as they did not grow up during this technological age. Secondly, elders often suffer from age-related impairments. Cognitive disabilities resulting from age degenerative processes, can significantly increase the learning curve of an elder, making it difficult for them to learn new skills. Additional cognitive problems include limited short-term memory, lower coordination capacity, lower sensory capability and slower ability to react (Dong et al, 2002). Physical impairments, related to sensory loss, are another obvious effect of ageing (Hawthorn, 2000). Such impairments affect visual, auditory and tactile capabilities, as well as speech intelligibility, further distancing the elderly from technology. Another significant hindrance to adopting technology is the elderly's' sometimes negative attitudes towards technology, which they perceive as unfamiliar or unnecessary. Finally, many systems themselves are often poorly designed and hence complex to use, even for the average user. Therefore, it is critical that designers of systems consider the requirements of the elderly, who have vastly different needs to the average-aged user, if such systems are to become more widely useful to a larger context of users.

Multimodal interfaces can potentially enable elder users to benefit from technology. Verbal

communication between humans is often supplemented with additional sensory input, such as gestures, gaze and facial expressions, to convey emotions. Multimodal systems that process two or more naturally co-occurring modalities, aim to emulate such communication between humans and computers. The rationale for multimodal HCI is that such interaction can provide increased naturalness, intuitiveness, flexibility and efficiency for users, in addition to being easy to learn and use (Oviatt et al, 2000). The naturalness and intuitiveness of multimodal HCI are important factors in decreasing the complexity of applications that employ multimodality. This in turn may contribute to decreasing the learning curve of the elderly, when learning to use such applications. Furthermore, it may reduce the user's apprehension towards technology as multimodal interaction, using speech and gestures for example, may seem a more familiar means of interacting with a computer, than the traditional mouse and keyboard. Motor and sensory issues relating to elderly users can be overcome through the ability for them to choose the mode of interaction that best suits their capabilities. For example, an elderly user with arthritic problems might find speech a preferable interaction mode to handwriting or touch. On the other hand, a user whose speech might be unclear due to a lack of articulation for example, or who has an auditory impairment might prefer to interact through touch or gesture. Each of these potential benefits, coupled with the fact that multimodality has been shown to reduce complexity of human computer interaction in many application domains, makes multimodality an ideal paradigm with which to help elderly users begin to embrace technology.

In addition to intuitive input modalities, the large range of relatively inexpensive mobile devices currently available, ensure applications supporting multimodality are available to a broad range of diverse users in society, including the elderly. As such, multimodal interfaces are now incorporated into various applications contexts, including healthcare (Keskin et al, 2007), ap-

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