Chapter 4
Augmentative and Alternative Communication Systems for the Motor Disabled

Alexandros Pino
National and Kapodistrian University of Athens, Greece

ABSTRACT

This chapter discusses Augmentative and Alternative Communication (AAC) for individuals with motor disabilities. Motor disabilities do not only affect movement, but very often also affect speech. In these cases where voice is very weak, speech is unintelligible, or motor problems in the human speech production systems do not allow a person to speak, AAC is introduced. Aided and unaided communication is explained, and low and high tech AAC examples are illustrated. The ITHACA framework for building AAC applications is used as a paradigm in order to highlight the AAC software lifecycle. The same framework is also used to highlight AAC software design issues concerning component-based development (the open source model and the Design for All principles). Key features of an AAC application like virtual keyboards, scanning techniques, symbol dashboards, symbolic communication systems, message editors, symbol translation, word prediction, text to speech, and remote communication are presented. Finally, practical hints for choosing an AAC system are given and a case study of informally evaluating it is cited.

INTRODUCTION

For people with complex communication needs, those with motor and speech impairment, daily routine as well as rehabilitation and educational programs often include the use of Augmentative and Alternative Communication (AAC) aids

(Beukelman & Mirenda, 2005). AAC is an umbrella term that encompasses the communication methods used to supplement or replace speech or writing for those with impairments in the production of comprehensible spoken or written language (Fossett & Mirenda, 2009). AAC is used in a wide range of speech and language impairments, including congenital impairments such as cerebral palsy (McNaughton, Light, & Arnold, 2002), intellectual impairment and autism (Shook & Coker, 2006)

(Mirenda, 2003), and acquired conditions such as amyotrophic lateral sclerosis (Doyle & Phillips, 2001) and Parkinson's disease (Beukelman & Garrett, 1988). AAC can be a permanent addition to a person's communication or a temporary aid.

Modern use of AAC began in the 1950s with systems for those who had lost the ability to speak following surgical procedures (Lloyd, Fuller, & Arvidson, 1997). During the 1960s and 1970s, spurred by an increasing commitment towards the inclusion of disabled individuals in mainstream society and developing the skills required for independence, the use of manual sign language and then graphic symbol communication grew greatly (Koul, Corwin, & Hayes, 2005). It was not until the 1980s that AAC began to emerge as a field in its own right. Rapid progress in technology, including microcomputers and speech synthesis, has paved the way for communication devices with speech output and multiple access options for those with physical disabilities.

AAC systems are diverse: unaided communication uses no equipment and includes signing and body language, while aided approaches use external tools and range from pictures and paper communication boards to speech generating devices (Light, 1988). The symbols used in AAC include gestures, photographs, pictures, line drawings, letters and words, which can be used alone or in combination. Body parts, adapted mice, or eye tracking can be used to select target symbols directly, and switch access scanning is often used for indirect selection. Message generation is generally much slower than spoken communication, and as a result rate enhancement techniques may be used to reduce the number of selections required. These techniques include word prediction or completion. In which the user is offered guesses of the word or phrase being composed.

Computer based solutions include on-screen dashboards that present selectable grids of concepts for communicating with others synchronously or at a later time (i.e., composing and storing messages). These grid-based applications offer great opportunities for non-literate users, such as children or language impaired individuals (Hourcade, Pilotte, West, & Parette, 2004). With a set of well-chosen icons, they could still use a sufficient vocabulary to communicate with others. The same or similar grids can be populated with letters of the alphabet, words, and phrases, serving literate users as well.

The evaluation of a user's abilities and requirements for AAC include the individual's motor, visual, cognitive, language and communication strengths and weaknesses. Studies show that AAC use does not impede the development of speech, and may result in a modest increase in speech production (Millar, Light, & Schlosser, 2006). Users who have grown up with AAC, report satisfying relationships and life activities, however, they may have poor literacy and are unlikely to be in employment (McNaughton, Light, & Groszyk, 2001).

The International Society for Augmentative and Alternative Communication (ISAAC) is a leading organization that promotes awareness and research on AAC, and holds the ISAAC Biennial Conference (ISAAC, 2013). Another important resource for current trends on AAC research is the Augmentative and Alternative Communication journal (Informa Healthcare, 2013).

The first section of this chapter will explore special communication needs. In the next section, the various types of AAC and symbols are presented, and state of the art follows. Next, the AAC product life-cycle is explained taking the example of a framework for developing AAC applications called ITHACA. The AAC application features section includes the description of possible modules like on-screen keyboards, on-screen communication boards, scanning patterns and control techniques, speech synthesis, word prediction, message editors, symbol translation, and remote communication. Next, a number of questions are given, that have to be answered by the AAC professionals and users' families. In order to correctly select an AAC system. The informal

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