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Towards the improvement of Augmentative and Alternative Communication through the modelling of conversation

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Abstract

Non-speaking people who use Augmentative and Alternative Communication (AAC) systems typically have low rates of communication which reduces their ability to interact with others. Research and development continues in the quest to improve the effectiveness of AAC systems in terms of communication rate and impact. One strategy involves making the basic unit of communication an entire utterance, and designing the AAC system to make the storage, retrieval and production of utterances as easy and efficient as possible. Some approaches take this further and include texts, narratives and/or multimedia material for use in conversation. AAC systems operating in such a manner require a structure for containing and managing conversational material and supporting the production of output during conversation. Ideally such a structure should be modelled on the way actual conversations proceed. A number of partial models for this have been presented thus far. These are reviewed in the paper and an integrated model is then proposed that includes both the structure of a conversation and the way in which an AAC system might produce conversational output (e.g. utterances, texts, multimedia items or combinations of these). Modelling the process in this way gives a structure with which an AAC system can organize the support and guidance that it offers to the person using the system. The paper concludes with consideration of three areas of development for further investigation.

Keywords: AAC; Augmentative communication; Conversation; Modelling; Non-speaking; Scaffolding

1. Introduction

Inter-personal interaction is more difficult for people who use Augmentative and Alternative Communication (AAC) than for natural speakers. People using AAC typically have very low rates of communication because of their disabilities, so communication acts produced during real-time interaction tend to be brief and delayed. It is reported that conversation can proceed at rates of 150–250 words per minute for natural speakers who have no disabilities, whereas people who need to use AAC are limited to much lower rates, for most less than 15 words per minute (Foulds, 1980; Beukelman and Mirenda, 2005). A typical AAC interaction will involve a disabled non-speaking person using an AAC system to communicate with a speaking person. Because of the slowness of the interaction, it is very difficult for people to relate narratives or hold forth for any extended period of time if they are dependent on AAC for communication. This tends to reduce the spontaneity and vivacity of interactions and to cause them to be of relatively short duration. It also

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influences attitudes and expectations that speaking people have regarding interactions involving people who use AAC (McCarthy and Light, 2005).

Researchers have investigated many avenues for increasing the interactive communication rate and responsiveness possible in AAC (Beukelman and Mirenda, 2005). Some notable success has been achieved in this area, although communication rates still fall short of those achieved by speaking people who do not need to use AAC. The principal advance has been achieved through the use of whole utterances (e.g. phrases and sentences) pre-stored in the AAC system and retrieved later at the point-of-use when they are required during live conversation (Baker, 1982; Waller et al., 1990; Vanderheyden et al., 1996; Langer and Hickey, 1998; Alm and Arnott, 1998; Higginbotham et al., 1999; Todman and Alm, 2003; Hine et al., 2003; Todman et al., 2008; Dempster et al., 2010b). This was aimed at assisting non-speaking people to efficiently and effectively retrieve and use pre-stored text sequences (e.g. stories, personal biographical material, anecdotes, family news) as well as phatic remarks such as greetings, responses and farewells, and to do so in a conversational situation. Without this approach, it is necessary for utterances to be constructed in real time during conversation, which is very slow and limits greatly the flow and liveliness of a conversation. While it is important for on-line construction of utterances to be possible in an AAC setting, so that unique statements can be made by anyone using AAC, it is the use of pre-stored or automatically generated utterances that has brought most of the increased pace and responsiveness to AAC conversation that has so far been achieved. Output of such utterances to conversation partners is achieved typically via synthetic speech; an utterance-based AAC system usually has a speech output modality, in which case it can be described as a VOCA (voice-output communication aid) or an SGD (speech generating device). Other output modalities are also possible; visual display of messages to communication partners can be used, for example, and multimedia material (images, audio and video) can be included.

As the AAC system needs facilities for on-line construction or modification of output items as well as search and retrieval methods for accessing stored items, there is a need for the system to know where it is in a conversation, how the various stages of a conversation fit together, and the sequence of events that are likely to occur during a conversation. It needs this in order to be able to optimize the selections and predictions that it makes as it tries to present its user with appropriate things to say as their next contribution to the conversation. Some of these items will require modification or editing before being output to the conversation partner, and so efficient online editing and prediction facilities are needed. It is therefore desirable for the AAC system to contain a model of conversation that gives the system a structure to operate within, a structure that indicates what type of step should be taken next, and what type of item is required next in the conversation. This will guide the system in its search for stored items and dynamic configuration of the system for modification or replacement of such items under the control of the user. The efficiency of the process and hence the responsiveness of the user in a live conversation situation is dependent on the ability of such a model to accurately guide the AAC system. Increasing emphasis will be placed on this modelling as AAC systems acquire larger stores of utterances, narratives and documents, including multimedia material. The need to manage and marshal this store of material for best use during conversation will mean that the conversation model within the AAC system will be called upon to make ever more accurate and relevant use of these resources. This paper discusses issues involved in modelling conversation within AAC in the context of real-time message-based communication (where messages can consist of utterances, texts, multimedia items or combinations of these) and proposes an integrated model to represent and under-pin the process within an AAC system. It commences with an overview of methods that have been investigated for supporting effective conversation in AAC.

2. Supporting conversational interaction in AAC

A range of research projects has sought methods to support conversational interaction for people who use AAC. Utterance-based communication is discussed in Section 2.1, followed in Section 2.2 by methods for making it easier for people to enter or select message elements for constructing utterances in AAC systems. Section 2.3 discusses approaches that have been investigated for the storage and management of communication material for use in AAC, including topic-related material, humour, narrative and multimedia content. This leads into how topic progression within conversation in AAC has been considered (Section 2.4) and its subsequent appearance in AAC system design. AAC researchers have investigated how techniques developed within Natural Language Processing (NLP) and Generation (NLG) might be applied within AAC systems; NLP and NLG can assist in the production of well-formed utterances, for example, and this is discussed in Section 2.5.