Text Entry in Augmentative and Alternative Communication

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Abstract. A concise outline of background is given on assistive methods for writing and communicating for non-speaking people, highlighting the role of efficient text entry in augmentative and alternative communication (AAC). AAC systems are designed to assist people with communication impairments to interact with others and to compose messages and other documents. Efficient text entry is therefore of great importance in AAC, in order to make it as easy as possible for text users to enter text into AAC systems. Continuing research and development is needed in the area of text entry to improve the efficacy and efficiency of AAC systems.

1 Introduction

Augmentative and alternative communication (AAC) systems are designed to help people with communication impairments to interact with others. Non-speaking people, for example, can use AAC systems to assist them to communicate. With synthetic speech as an output mode on AAC systems, "spoken" interaction is possible for people who otherwise cannot speak. Efficient text entry to AAC systems is very important in order to help such people to produce original statements as easily and quickly as possible in conversational situations. Efficient text entry is also needed to assist in the writing of letters and messages and the composition of essays, stories and papers. (Some people with communication impairments use symbols or sign languages instead of text, depending on their linguistic abilities; the focus of this paper is specifically on the use of textual language in AAC and particularly the need for efficient text input in that field.) While conversation can proceed at rates ranging from 150 to 250 words/minute for speaking people with no communication impairments, those who need to use AAC are usually limited to much lower rates (less than 8 words/minute in some cases) [6]. Physical disability often accompanies speech impairment and can make operation of technology-based systems, including AAC systems, very difficult and slow. Special input methods, some including assistive techniques that are intended to make text entry easier or faster, have been developed over many years to try to improve this situation. These methods usually invoke extra cognitive effort for the user, however, necessitating trade-off between cognitive load and physical difficulty

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in entering or encoding information into an AAC system. Amongst such assistive techniques are text encoding and input methods involving abbreviation, prediction and disambiguation, typically exploiting the redundancy in natural language.

2 Assistive Techniques for Text Entry

Examples of assistive methods for text entry include abbreviation expansion [24, 32], character prediction [5], word and string prediction, character disambiguation for reduced (Fig. 1 {right}) and special keyboards, symbolic entry and coding methods [3, 4, 8, 9, 12, 13, 20, 21, 26, 27, 34]. Natural Language Processing (NLP) techniques [19, 25] have been brought into play in AAC; the Compansion [10, 22] system, for example, was designed to process and expand spontaneous language constructions such that a group of uninflected content words would be expanded automatically into a full phrase or sentence.

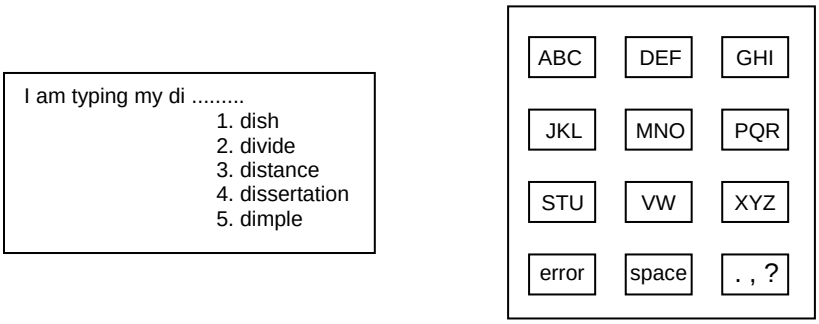

Fig. 1. {Left} An example of word prediction, where a menu of words is presented based on the initial characters ("di") of the partially-completed word in the line of user-entered text; the user can select one of the words, e.g. "dissertation", with a single selection action, thus reducing the overall number of selection actions required to type the word. **{Right}** An example of a 12-key ambiguous (reduced) selection layout for typing text; auto-disambiguation is used to help resolve the ambiguity caused by the multi-character keys (as on mobile/cell phones). (Different layouts and character-key assignments can be assembled [3, 13, 20]; such reduced layouts are designed for people whose disabilities mean that a small number of large keys is easier to access and use than a large number of small keys)

One of the more recent developments in predictive interfaces is the Dasher system [34], a text entry interface driven by continuous pointing gestures. It can be operated with various input devices such as eye-trackers, joysticks and touch-screens appropriate for users with special needs. Its performance is reported [35] thus: "The eye-tracking version of Dasher allows an experienced user to write text as fast as normal handwriting - 25 words per minute; using a mouse, experienced users can write at 39 words per minute." These input rates are very appropriate for those writing text as an off-line task (for example in the composition of essays or other written documents) and will also assist when new statements need to be entered during conversation.

3 Text Storage and Retrieval

While a number of advantages might result from the various ways of using coding and prediction at the word and character levels in AAC, such as easing of the physical task of entering text or assistance with spelling and use of language, the large increase in word rate required to give good rate of conversation is not obtained by these means. Further increase in rate is required, and attention turns instead to the strategy of storage and recall of larger text passages, including phrases, sentences and paragraphs, within an AAC system. The process then becomes more one of text retrieval than of text entry [1], and efficient text retrieval becomes a key requirement for an AAC system containing stored text for use in conversation. Prediction methods and appropriate structuring of the textual information are needed to help the system to make relevant text items readily available for use by a non-speaking person during conversation.

4 Pragmatics and Conversation Modelling

Conversation can be relatively predictable in the paths and structures that it adopts; conversational modelling and pragmatics have therefore been applied to try to exploit this [1, 23, 28, 29, 30, 31]. Phatic communion strategies can be used to facilitate social interaction, for example, using items such as greetings, farewells, small-talk and back-channel and filler remarks [2] to enhance those aspects of communication that establish rapport between people rather than simply perform information transfer. Phrases, sentences, scripts, schemata and frames [7, 11, 14, 15] can also be stored within AAC systems for recall and use within conversational or transactional settings. The script/schema approach is intended to apply an anticipated sequence and structure of typical transactional interaction, for example, to enable the system to make available relevant phrases that are appropriate for the next step in a particular dialogue (such as ordering food in a restaurant or consulting a medical practitioner). Research has also been conducted into story-telling in AAC, with complete stories [33], including multimedia stories and personal narrative [16, 17, 18], being stored for use within an AAC context. The design of the user interface and text retrieval method is paramount in determining how easy such a system is to use and how quickly and efficiently items can be retrieved for use in conversation.

In experiments in this area, a non-speaking person was seen to achieve a conversational rate of 64 words/minute with well-rated quality of conversation using an AAC system (TALK) based on conversational pragmatics [29]. Higher rates, of about 80 words/minute, were seen when greater use was made of extended personal narrative [28]. While such rates are not as high as typical natural speaking rates, this outcome indicates that a substantial improvement in word rate is possible within an AAC context through the use of text storage-and-retrieval and that the resulting interactions can be judged to be good conversations. The TALK system combined several strategies, such as phatic elements in a CHAT facility [2] to facilitate social communion between conversation partners, context appropriate comments, and conversational perspectives to assist graceful movement from topic to topic within conversations.

5 Continuing Importance of Assistive Text Input

Text input continues to be needed within storage-and-retrieval based AAC systems for the creation, during conversation, of novel and spontaneous statements. Assistive text input methods play a vital role in facilitating the prompt production of these remarks. Text input is also needed to support off-line writing tasks, including the composition of essays, stories, letters and messages. There is therefore a continuing need in AAC for improved text input methods to perform more accurate textual prediction within a framework of more efficient and usable user interfaces that do not impose excessive cognitive demands upon the user.

6 Migration to the Mass-Market

The early development of assistive text input techniques such as disambiguation and prediction occurred particularly in the area of special needs and AAC where there was a clear role for them to play in facilitating text input for people with disabilities. The migration of these techniques to mass-market applications followed the widespread adoption of text input to mobile devices such as mobile (cell) phones and PDAs. Mobile devices present restrictive or "disabling" interfaces to their users because of the limited space available for the display screen and keypads. Phone keypads usually contain only ten digit keys and a small number of additional control keys, for example, which means that multiple alphabetic characters are assigned to each digit key for purposes of text input (in a manner similar to that in Fig.1 {right}). Abbreviation is used extensively in text messaging on mobile devices; assistive text input techniques such as disambiguation and template phrases have also been incorporated into mobile devices to help users to enter text on reduced keypads. Assistive input techniques have thus found mainstream application in this market. It may be that other AAC techniques will make this transition; template phrases already represent an element of message pragmatics within text messaging facilities, for example.

7 Conclusion

After many years of research and development in the field of AAC, there remains a substantial difference between the typical conversational rates that can be achieved by most non-speaking people who use AAC and those achieved by people with no communication impairments. While the highest conversational rates in technology-based AAC have been achieved using pragmatics and text storage-and-recall methods, it is still essential for an AAC system to possess text input facilities. Spontaneous interaction and general writing tasks depend upon them. Further research and development in the field of efficient text entry could therefore have very positive outcomes for people who use AAC equipment, as well as for those who use text input in general-purpose applications. Further work in this field should therefore be encouraged and promoted.

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