Writing script-based dialogues for AAC

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Abstract

AAC (Augmentative and Alternative Communication) devices are often used by disabled people who are non-speaking, in order to assist them to communicate. However, many such systems require the user to build up an utterance word-by-word each time, and are thus often laborious for the user and slow (and thus less effective) in communication.

For this reason, an AAC system was developed which relies on pre-stored scripts and an engaging user interface to predict and guide the user through many standard dialogue situations with a minimum of effort. In order to allow individuality in using the system, an authoring package has been developed. This allows users (or their carers) to modify existing scripts or to add new scripts into the system, and has also been designed to facilitate exchange of scripts between users.

The systems developed utilise current speech synthesisers for spoken output, and are commercially available in English, Dutch and German versions.

1. Introduction

People who are non-speaking often have other physical or mental disabilities, and consequently any speech prosthesis system must be simple to use, generating as many letters or words (per key pressed) as possible. Most systems currently available commercially store words; often several keys must be pressed to access each word, though a complete utterance can be synthesised as a whole once assembled. As these systems are word based, it is difficult to pre-store utterances, even if a range of likely utterances is known in advance. A wide range of synthesis qualities is available, though often a word each time, and are thus often laborious for the user and slow (and thus less effective) in communication.

To improve communication speeds, letter and phrase prediction schemes can be used [1]; this also reduces the load on the user. As such systems are acting as the voice of the user, it is highly desirable to be able to convey some personality in the output speech, and this requires availability of better quality synthesizers than are currently adopted, or the ability to incorporate new synthesizers as they become available.

The purpose of the systems described in this paper is to tackle all of these problems, to offer a highly predictive and easy-to-use prosthesis which offers high quality speech output. In addition, the ability to create and pre-store common dialogues is offered, while keeping navigation through these dialogues as simple as possible to minimise the cognitive load on the user. Both systems run on standard PCs, including laptops and PC-based communication systems (such as the Cameleon [2]) – normally the authoring system would be used by a carer, who would then download the utterances into the prosthesis system running on a disabled user’s laptop.

2. ScripTalker

ScripTalker [3, 4] is an AAC System which is designed to assist a user to conduct transactional conversations i.e. to attain goals such as buying items in a shop, consulting a doctor about health issues, or ordering a meal in a restaurant. It is based on the concept of scripts [5] which has noted potential within the AAC field [6, 7] and it can assist its user to progress rapidly through a conventional interaction in an ordered fashion, prompting the user with appropriate phrases for use at the current stage of dialogue. The system contains a number of scripts, each one relating to a particular scenario which the user might meet in daily life. Each script contains phrases relevant to the transactional scenario which it represents, and these phrases are made available to the user in a number of graphical scenes which depict typical situations associated with the transaction (e.g. in the shop, restaurant, or doctor’s surgery). The user can easily confirm selection of a phrase by simple selection actions, whereupon the system outputs the phrase using synthetic speech.

There is sufficient flexibility in the system to let the user vary the sequence of spoken items and compose original phrases, so the user is able to vary statements and responses during a transactional conversation. The availability of the scripted phrases gives the system great potential for improving the efficiency and responsiveness of the user in such situations. The computer-based modelling of transactional sequences augments the communication ability of the user by simulating some of the planning of statements and responses which is required during conversation, and using that to enable the AAC system to prompt the user with appropriate phrases. ScripTalker is also equipped with phatic phrases for the opening and closing phases of a conversation and feedback throughout the interaction. Unique phrases can be composed using an on-screen keyboard augmented with word prediction, and either used immediately (for example when a specific response is required and this has not been pre-stored) or stored for later use if required (typically to add simple responses to the system without modifying the script). ScripTalker has optional user adaptation and prediction, allowing the system to adapt to the specific method of operation of an individual user. Integrated environmental control is also a standard feature, allowing control of external devices such as lights, from within a script. The script mechanism operates behind an attractive easy-to-use interface, which can be controlled by mouse, touch screen or via a scanning mechanism.
The ScripTalker interface appears in Figure 1, showing a typical scene. The main scene contains a number of objects, each of which, when selected, produces an item of dialogue (shown in the top window) and/or executes an action. The scenes are generally constructed with a left-to-right sequence in mind, and the next phrase prediction (indicated by a heavy outline) follows this sequence. Program navigation buttons are situated down the left side of the screen.

![FIGURE 1: ScripTalker interface](image)

3. ScriptAuthor

ScripTalker must contain a range of useful scripts in order for it to be able to give maximum support to its user by way of offering useful phrases, and the preparation of new scripts can be an involved process. ScripTalker contains scripts for some high priority situations, but it is desirable to extend this repertoire in order to give the user access to a greater number of transactional situations, and to allow scripts to be customised for the needs of individual users.

An authoring tool called ScriptAuthor has therefore been developed to facilitate the script development process, enabling therapists and carers to efficiently construct new scripts; this would normally be done “offline” and the completed script downloaded into ScripTalker for use. The script format being used also makes it possible for scripts to be shared, so that it will be possible for libraries of scripts to be assembled from which users can select scripts which suit their individual situations and needs, and make further customisations if required.

The interface to the system has been designed to be as simple to use as possible, while retaining flexibility in the method of script entry - in order for the Script Author software to be widely applicable it should cater for different problem solving approaches. A user group was established to help advise the researchers on the best approach to developing ScriptAuthor. After seeking background information on appropriate approaches to the design of authoring software, initial investigations with the user group (including asking them to design scripts on paper) indicated that some preferred to take a top-down approach (starting with the overall script idea and working down to utterance level), while some preferred a bottom-up approach (starting with a set of required phrases and putting these together into a script structure). The ScriptAuthor interface was thus designed to cater for both of these approaches at once, showing the overall hierarchical structure of the script in development, while simultaneously showing graphically the current scene and phrases being worked on.

![FIGURE 2: ScriptAuthor interface](image)

3.1. Designing a script

In use, ScriptAuthor automatically guides the author through the main stages of creating a basic script; the author can then begin to add their own scene background images and objects to the scenes. The various hot-spots associated with objects can be linked to phrases to be spoken, or to actions to be carried out (e.g. moving to another scene or to environmental control functions). As well as "left-to-right" scenes depicting a conversational exchange, authors can also design "chart" scenes which allow the end users to make choice selections from lists of similar items (e.g. “drinks” chart, “parts of body” chart).

ScriptAuthor also provides authors with a library of backgrounds and common object images, and the ability to add in their own images via a scanner or digital camera, or importing from common graphics packages; some image manipulation features are also included within ScriptAuthor itself. To provide visual clues within a scene, backgrounds are shown in shades of gray while active objects are shown in colour - this indicates to the user which parts of the scene are connected to actions.

A major feature of ScriptAuthor is a subwindow which offers continual quality control advice during script creation. This shows warnings and general comments regarding design of the script and associated graphics as the script is built. This advice includes comments on size and position of objects and associated hot-spots and warnings if too many objects are added (see bottom of Figure 2).

3.2. Script exchange

The final output format of the created scripts is in a form similar to SGML (Standard Generalized Markup Language). This ensures the maximum flexibility in the sharing of scripts designed to cater for both of these approaches at once, showing the overall hierarchical structure of the script in development, while simultaneously showing graphically the current scene and phrases being worked on.
and addition of extra features at a later date. Scripts in this format can be imported into ScripTalker to form part of the user's communication repertoire, or imported back into ScriptAuthor to enable further editing or customisation to be carried out.

ScriptAuthor includes a script export option which produces a single package containing all elements of the script - scene graphics, hotspot locations, utterances etc. This facilitates interchange of scripts as all elements are kept together. It is hoped that this ease of script interchange will enable users to rapidly build up their own individual library of scripts which will be useful to them.

4. Synthetic Speech Output

The primary mode of operation of ScripTalker is as a communication prosthesis for a nonvocal user, with synthetic speech reading aloud the utterances as they are predicted. Incorporation of a text-to-speech system able to handle unrestricted text was thus a basic requirement, with the further requirement that several languages had to be supported (initially English, Dutch and German).

The Microsoft Speech Application Programmer's Interface (SAPI) [8] was adopted to provide a standard interface between the systems and a range of compatible synthesisers. The SAPI allows the user to install a number of synthesisers on their system, and speech output can be produced by selecting the required synthesiser. ScripTalker can thus output using any of the installed synthesisers in this way, and future SAPI synthesiser releases should also work directly with the system.

The initial release of the product uses any SAPI-compatible synthesiser for English (it has been tested with Infovox (formant based), Laureate (concatenated speech) and the Microsoft TTS engine), Fluent Dutch (diphone based) for Dutch [9] and Infovox for German [10]. Output utterance text is also written to the system clipboard, facilitating exchange with other applications and pre-SAPI synthesis packages which can read the clipboard.

5. Evaluation

Throughout the design process of both ScripTalker and ScriptAuthor, user panels were consulted on a regular basis. These comprised a disabled user panel of around a dozen nonvocal users who commented on the designs and contributed suggestions on features and the sorts of situations where they would like to use an AAC system but currently do not. The second panel of speech therapists and carers contributed primarily to the design of ScriptAuthor.

Formal evaluations of ScripTalker have also been conducted. A functional simulation was performed using the standard ScripTalker, the ScripTalker interface but with the script mechanism disabled, and an on-screen keyboard as control. Results showed a substantially greater number of words produced per activation in the case of standard ScripTalker. Evaluations with disabled users have also been conducted in both the UK and the Netherlands, using formal role-playing situations as well as longer-term field trials, and users have been enthusiastic about using the system.

ScriptAuthor has also been tested in field trials with therapists. A training period was given, after which they were asked to build a script with the system, and make comments. The system was found to be straightforward to use, and therapists were enthusiastic about being able to add custom scripts to their clients' systems and to share scripts created by other users.

A more detailed discussion of the evaluation procedures and results of both the ScripTalker and ScriptAuthor tests will be forthcoming in future publications.

6. Conclusion

This project has successfully developed a novel AAC system and a simple-to-use authoring package. Technologically, the system utilises scripts as a method for structuring pre-stored dialogue utterances and facilitating phrase prediction, and can utilise a range of commercial speech synthesisers. From the user's point of view, the system offers an engaging interface and the prediction simplifies navigation through the interactions. The script authoring package allows carers to easily construct and exchange scripts.

7. References

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