

## ASSISTIVE TECHNOLOGY

# A computerised communication aid for people with aphasia

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### Abstract

**Purpose.** To develop a portable computerised communication aid for aphasic people to support communication in everyday life.

**Method.** A multidisciplinary team of aphasiologists, augmentative and alternative communication specialists, speech and language therapists and technicians developed a portable, modular system, PCAD (portable communication assistant for people with dysphasia), running on a commercially available handheld computer. The system was tested in a multiple case study. Aphasia therapy services in the UK, Portugal and The Netherlands referred 28 people with aphasia, who were considered eligible for a computerised communication aid. Participants were trained following a protocol and used the device in self-chosen real life settings.

**Results.** Six of the 28 selected aphasic patients decided not to test the device; 22 participated in the training. All 22 learned to operate the aid, 17 used it functionally, in everyday life. Five people did not use the aid outside the therapy room, although they were able to operate the aid and to use it in role play. These unsuccessful clients were younger, and tended to have a shorter duration of the aphasia.

**Conclusions.** Carefully selected aphasic patients may benefit from a computerised communication aid, using it functionally in everyday communicative settings.

### Introduction

It is generally agreed that patients with a severe aphasia ‘communicate better than they talk’ [1]. Alternative and Augmentative Communication (AAC) strategies may be high-tech or low-tech. Low-tech communicative strategies are often trained in aphasia therapy. These may include gesturing, mimics, pointing, drawing and writing, or the use of low-tech aids e.g., communication books with written words and pictographs [2–5].

The use of high-tech communication aids, however, is very restricted. AAC devices developed for other groups with communicative disabilities are not very useful, while only a few devices have been specifically designed for aphasia [6–8]. Although aphasic patients are reported to be able to operate an aid and to learn the vocabulary, functional use in everyday communication is not reported [7,9,10].

Patients with a severe aphasia comprise a heterogeneous population, whose linguistic skills, cognitive capabilities and communicative needs vary considerably [11,12]. This diversity of capabilities and needs is one reason for the ‘discrepancy between the number of persons with aphasia who are AAC candidates and the number who are AAC recipients’ [13].

A multidisciplinary team of technicians, aphasiologists and AAC specialists developed a computerised communication aid for aphasia: PCAD (portable communication assistant for people with dysphasia). To meet the needs of this heterogeneous population, a flexible system is required that is portable and easy to operate with one hand. To achieve maximum flexibility a modular system was developed that offers the use of both digitised *and* synthesised speech, pictures, symbols, written text and sound. The system has to be individualised for each patient. It



Figure 1. PCAD: portable communication aid for dysphasic people.

was decided to develop an open system, running on a commercially available palmtop computer.

A development process was introduced, in which the clinical partners proposed and discussed many concepts of systems to support aphasic communication; these ideas were based on traditional low-tech communication strategies. From this 'wish list', the most promising concepts were developed in an iterative process and became modules in PCAD.

### **PCAD: The communication aid<sup>1</sup>**

PCAD provides seven modules; for each patient, only the relevant modules are selected. The central module is an 'empty' hierarchical vocabulary, enabling the therapist to build a personal vocabulary for each patient (Figure 1).

The software is called Touchspeak<sup>®</sup> and includes two packages:

The *Touchspeak designer* software runs on the therapist's PC and is used to design each client's personal system. Together with the client, the therapist chooses the relevant modules and configuration, and builds the vocabulary using pictures, line drawings, photographs and text. Spoken messages are either selected from a CD (when standard), or entered directly into the PC using a microphone or text-to-speech software (when individualised). This personally tailored system is downloaded on the client's own palmtop computer.

The *Touchspeak* software runs the system on the client's palmtop. The aphasic user can select messages by choosing options on the touch screen.

The following modules were designed:

#### *Hierarchical vocabulary, digitised speech output and/or synthesised speech output*

The hierarchical vocabulary enables the therapist to include photographs, pictures, symbols, words and sentences, digitised and/or synthesised speech. In

this way, the personal vocabulary is built, containing personalised or standard messages. The colour screen shows one or more buttons; clicking a button brings the user deeper into the hierarchy and/or activates a message, with or without speech output.

#### *Phonemic cueing*

This option allows sound to be broken down into individual phonemes; it is possible to sound out only the first sound(s) of a spoken message, as a cue for the user to produce the message. For example, an aphasic patient who wants to be able to say his son's name (Matthew), may select the relevant button and activate the first syllable (Ma...) and subsequently say 'Matthew'.

#### *Typing*

This option is provided for those aphasics who are able to type (parts of) words. The keyboard is used to type a message. This message can be stored in the 'gallery', and used again at later occasions. The user may keep the gallery up to date by adding new messages and deleting old ones.

#### *Sketch*

This module enables clients to draw and store their own colour drawings. The user can draw (or write) directly on the computer screen. The drawings can be stored in the 'gallery' and used again in communicative situations. They can also be used in the vocabulary database, allowing the aphasic user to create a completely personalised system, designed and created by themselves.

#### *Newspage*

This is a text page on which recent information can be typed in. Text is stored in categories. Relatives

may use this option; they can enter recent, relevant information for the aphasic to use when communicating with others.

#### *Message Bar*

The Message Bar allows to store one or more messages from the hierarchical vocabulary at the bottom of the screen. In this way, the user may combine more than one vocabulary item. The message bar enables users to keep several messages available, or to create 'agrammatic' messages by selecting vocabulary from different parts of the hierarchy and 'joining' them into a sequenced 'sentence' on a message bar.

#### *Facilitator editor*

This is a simplified editor for use by carers to directly configure the handheld device, and modify and update the user's vocabulary, without using the PC programme Touchspeak Designer.

### **Multiple case study**

The Beta prototype of PCAD was tested by aphasic people and their speech and language therapists in Bristol (UK), Coimbra (Portugal) and Rotterdam (The Netherlands). Besides the ability to operate the device, the central issue was whether aphasic users will use the aid functionally, in real life situations.

All aphasic users were trained following a protocol; they used the device at home during a trial period.

Therapists in the three lands were asked to select candidates for a computerised communication aid. Because the study aimed at *functional* use, we chose to work with patients who had a good chance to learn to operate the aid (Table I). Aphasic patients were selected who had the following attributes:

- no severe cognitive impairment;
- relatively good auditory comprehension and limited verbal expression;
- specific communicative need and opportunity; and
- a supportive partner.

The aphasic and the therapist discussed individual needs in relation to what the aid had to offer, before deciding whether the client would enter the study. Before the training started each client, together with the therapist, decided which functional goals would be set.

Of the 28 possible candidates from the three countries, 22 were included in the pilot study and received PCAD training. Six patients decided not to participate in the study.

For each case the information about use in functional settings is based on observation by the therapist and on a structured post-therapy interview with the client and the most important communication partner.

The aphasic client played an active role in setting the goals of the intervention and in selecting and building the vocabulary. This was considered crucial for functional use, because this approach guaranteed that the aid was personally relevant.

The intervention had three stages:

#### *Interview and goal setting*

The interview with the aphasic patient and his/her partner provided information about specific communicative needs. This information was used to select communicative settings for which PCAD could be used. Together with the therapist, the aphasic set his/her own goals: e.g., using PCAD for telephone conversation, or shopping and buying clothes independently.

#### *Individual configuration of the device*

Based on the information about linguistic and cognitive skills and about personal preferences of the client, the therapist configured the aid, choosing relevant modules and deciding about the colours and the layout of the screen. This means that all clients' devices were different: some of them only used a hierarchy of written words without speech output, others used photographs and pictographs in their hierarchy together with the sketch option, etc.

#### *Training and vocabulary selection*

Having learned how to operate the device, the aphasic learned to operate the selected modules.

Table I. Data on the study group.

Total number of referrals	28
Male	20
Female	8
Age (years)	19–81 (Mean = 57)
Time post-onset	3 months to 13 years (Mean = 30 months)
Aetiology:	
LCVA	24
RCVA	2
SAB	1
TBI	1

LCVA, left hemisphere cerebrovascular accident; RCVA, right hemisphere cerebrovascular accident; SAB, subarachnoidal bleeding; TBI, traumatic brain injury.

During the training, several therapy sessions were devoted to building the hierarchical vocabulary. The therapist and the patient discussed the actual contents of the vocabulary, and the patient decided which messages would be included. The process of vocabulary selection went together with learning to navigate the hierarchical vocabulary. At first, the aphasic was asked to find specific vocabulary items; in later sessions role-playing was used, e.g., for shopping and for telephone conversations. If necessary, the therapist also included functional training, and training of the carer.

Some, but not all patients received some *in vivo* training: e.g., the therapist accompanied the patient in 'real life situations', such as shopping and visiting a pub. Vocabulary Selection and Training proved to be an intensive process and the number of sessions required per patient varied (Table II).

## Results

All 22 participants were able to operate the device and use it in role playing during therapy sessions. Five participants (23%) were unsuccessful and did not use the device in real-life situations.

Seventeen clients (77%) were successful functionally: they reported to use PCAD for at least one of the preset goals in the post-therapy interview with the client and his/her partner (Table III).

Unsuccessful users were younger (mean age 39 years) than successful clients (mean age 57 years; a *t*-test for related samples showed a significant difference between both groups ( $t = 2.91$ ,  $df = 20$ ,  $P = 0.01$ , two-sided). The difference in time post onset, with a longer duration of the aphasia for successful clients (mean 30 months) than for unsuccessful clients (mean 16 months), was not significant (Table IV).

## Discussion

All participants in this study learned to use PCAD during therapy: after training, they were able to operate the aid, navigate their personal hierarchical vocabulary, and use the device in role playing

situations. This indicates that a selected group of patients with chronic aphasia are able to acquire all necessary skills to operate this computerised communication aid and to improve their conversational skills within the therapy setting.

A majority also reported *functional* use of the device: the success rate of 77% for functional use is higher than expected. These patients used PCAD in daily life for specific communicative situations they had selected together with their therapists.

Only a minority (23%) did not use PCAD in daily communication, although they were able to operate the device and use it during therapy. Surprisingly, these clients were younger than those who did use PCAD functionally. There are two possible explanations for this effect.

First, it may reflect that therapists are inclined to invest more energy and optimism in the younger group and to give younger patients 'the benefit of the doubt'. Because of their youth, these patients are more urgent; however: youth does not guarantee success with computerised communication aids.

Second, successful use of a device may only occur when a chronic aphasic patient accepts the communicative disability, and is able to appreciate the need for supported communication. People who still hope to improve their linguistic skills often focus on linguistic training and they are less inclined to use an aid. For younger people this acceptance might be even more difficult.

This study indicates that the use of a computerised communication aid for aphasics is a promising new route to explore: carefully selected patients are able to use a computerised aid like PCAD, not only in the therapy setting, but also functionally, and enthusiastically, in everyday communication.

We conclude that the use of a computerised communication aid has an effect at the activities level, because it enables people with aphasia to communicate independently in specific activities.

Table II. Number of therapy sessions needed for the PCAD training.

	Number of sessions	
	Range	Mean
Vocabulary selection	2–4	2.7
One-to-one training with user	5–20	10.4
<i>In vivo</i> training	0–7	3.8
Training the carer	0–5	3.1

Table III. Outcome of PCAD training in the 22 participating patients.

	Number of clients	
	+ Success <sup>1</sup>	– Success <sup>2</sup>
Ability to operate the device	22	0
Ability to use the software	22	0
Functional use in communicative situations	17	5

<sup>1</sup> + Success: participants who reported to use PCAD functionally for more than one pre-set functional goal in everyday communication.

<sup>2</sup> – Success: participants who were able to use the device, but reported that they did not use it functionally.

Table IV. Mean age and time post-onset for successful and unsuccessful clients.

	+ Success (N=17)	- Success (N=5)	<i>t</i> <sup>1</sup>	df <sup>2</sup>	<i>P</i> values <sup>3</sup>
Mean age (years)	57	39	2.91	20	0.01
Time post- onset (months)	30	16	10.82	20	0.23

<sup>1</sup>*t*-Test for related samples.

<sup>2</sup>Degrees of freedom.

<sup>3</sup>Two-sided.

Our challenge is to find out whether selection in clinical practice should be as strict as in the present study; it is unclear in which ways patients with less favourable characteristics may benefit. This pilot study suggests that we need to find the balance between abilities and needs such that the system is easy to use, and meets individual needs.

## Note

1 PCAD is now commercially available in the UK, The Netherlands and Germany, under the name TOUCH-SPEAK.

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