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INNHOLD: Side

SPESIFIKKE LESE- SKRIVEVANSKER. - KOGNITIVE SÆRTREKK
Engvik, Ottem, Sletmo . . . 67

SPESIFIKKE LESE- SKRIVEVANSKER OG KJØNN, SETT I LYS AV SPRÅKLIGE SVIKT
Engvik, Ottem, Sletmo . . . 81

SPESIFIKKE LESE- SKRIVEVANSKER OG KARAKTERISTISKE UNDERGRUPPERINGER
Engvik, Ottem, Sletmo . . . 87

COMPUTER AIDED APHASIA THERAPI WITH A NEW SYSTEM PROGRAM
Kitzing, Christiansson, Eriksen . . . 95

BOKANMELDELSER . . . 104

VEILEDNING TIL ARTIKKELFORFATTERE . . . 106

Villco Trykkeri, Oslo

Computer Aided Aphasia Therapy with a New System Program

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SAMMENFATNING

Liksom inom många andra områden kan man inom logopedin notera en ökande användning av mikrodatorer. Artikeln ger en inledande översikt över applikationen av mikrodatorer vid omhändertagandet av afatiker. Härvid kan man särskilja åtminstone fyra avgränsade användningsområden, nämligen administration, diagnostik, hjälpmedel och behandling. I den fortsatta framställningen redovisas en pilotstudie, där fyra afatiker fått träna auditiv ordförståelse med hjälp av en Macintosh mikrodator styrd av en s.k. mus. Programvaran hade utvecklats bland annat med hjälp av ett nyligen utgivet systemprogram kallat Hypercard. Två av afatikerna visade stort intresse för denna typ av datoriserade språkövningar, medan de båda andra av skilda orsaker föredrog enbart konventionell behandling. Datorbaserad språkträning bör samordans väl med den ordinarie terapeuthandledda behandlingen. Alltför omfattande hjärnskador förefaller vara ett hinder för patienten att framgångsrikt engagera sig i sådan träning. Tidigare erfarenhet av datoranvändning tycks vara en fördel.

SUMMARY:

The application of micorcomputers in speech pathology has increased substantially in recent years. This paper gives an introductory review of the computerized management of aphasics which can be divided into at least four sub-areas, *viz.* administration, assessment, aids and therapeutics. The second part of the paper is an account of a pilot study of four aphasic subjects training auditory verbal comprehension by aids of a Macintosh microcomputer equipped with a mouse. The necessary software was easily generated by means of a newly published system program called Hypercard. Two of the aphasic patients showed great motivation to engage in this kind of computerized language exercise, whereas the other two preferred conventional training for different reasons. Computer aided language training should be well integrated in the ordinary aphasia therapy guided by the language pathologist. To make optimal benefit from such training, the patient should not suffer from all too extensive cerebral lesions. Earlier experience from computer activities seems to be an advantage.

YHTEENVETO:

Tietokoneavusteinen afasia-terapia uuden ohjelmointijärjestelmän avulla.

Kuten muillakin aloilla on logopediankin piirissä pientietokoneiden käyttö yleistynyt. Artikkelissa esitetään katsaus pientietokoneiden käyttöön afaatikkojen hoidossa. Tällä alueella voidaan erottaa ainakin neljä käyttöaluetta, nimittäin hallinto, diagnostiikka, apuvälinekäyttö ja varsinainen terapia. Kirjoituksessa esitellään esitutkimus neljän afaatikon auditiivisen ymmärtämisen harjoituksista hiiriohjatun Macintosh-tietokoneen avulla. Ohjelmiston luomisessa on käytetty mm. uutta ohjelmointityökalua nimeltä Hypercard. Kaksi potilaista kiinnostui tämäntyyppisestä harjoittelusta, kaksi muuta pitäytyi mieluummin perinteellisessä afasiaterapiassa. Tietokoneavusteinen harjoittelu tulee yhdistää mielekkäällä tavalla perinteelliseen terapiaan. Kovin laaja aivovaurio muodostanee esteen tämäntyyppiselle terapialle. Aiemmat kokemukset tietokoneen käytössä ovat ilmeisesti eduksi.

Automated programmed training of disturbed language abilites in aphasic subjects dates as far back as the middle of the sixties when Rosenberg & Edwards (1965) reported their automated multiple response method using a screen for stimulus presentation, a number of microswitches for the subject's responses, and flashes of mulitcoloured lights as a positive reinforcement of correct answers. About the same time, Keith & Darley (1967) reported on their Electric Board, enabling «aphisic patients to engage independently in therapeutic activities», *i.e.* different kinds of matching tasks. Positive feedback on correct answers was given by a flash light bulb, powered by a 6 volt dry cell battery. The device could be «reprogrammed» by changing the multicoloured wire connections between two rows of thumb screws.

Since then, computers have become commonplace in various fields of modern society and lately they have been introduced also in speech pathology, «Microcomputer Applications in Communication Disorders» is the title of a recently published handbook (Schwartz, 1984). The development of the field can be followed in the Journal for Computer Users in Speech and Hearing (CUSH) and the periodical Software Review published by ASHA. As to the application of computers in the management of aphasics, this field has been reviewed by Katz (1968), Stachowiak (1987) and in Swedish by Yngvesson and Sheats (1987).

The field of computerized management of aphasics can be divided into at least four sub-areas:

1. *Administration,* including booking of appointments, keeping of records and accounts, etc.
2. *Assessment.* Not only aphasia tests like the PICA- and the Token-tests are administered by computers at several centers nowadays, but also common neuropsychological tests like Raven's matrices, etc.

3. *Aids.* In recent years there is a growing awareness, that an aphasic's communication handicap to a certain extent may be overcome by resorting to alternative non-verbal strategies like the Amerind or BLISS code systems. A recent review of this field is found in Rose & al. (1988), called Non-vocal Approaches to Aphasia Rehabilitation by Helm-Estabrooks, who also developed the non-verbal Visual Action Therapy.

   By the same token, a number of computerized systems are now being developed with the aim to function as aids for alternative communication. Examples of such systems are the American computerbased Visual Communication System, C-VIC, by R.D. Steele (V.A. Medical Center, Palo Alto, CA), and the Datorbaserad bildkommunikation vid afasi, DBKA, by Yngvesson (cited from Yngvesson, Y., Sheats, A., Linell, S., project at the Styrelsen för Teknisk Utveckling, March 1987). Other devices to be mentioned in this connection are the Norwegian FALCK-3310, and the American ALLTALK, available from a company, ACS, in Pittsburgh. Some therapists report to have succeeded in using just standard microcomputer equipment (Macintosh) to compensate for their patients' linguistic and even motor deficiencies (Mossberg, 1986).

   A principally different approach is using the computer to generate phonemic cues for patients with problems of word retrieval (Bruce & Howard, 1987). After some time however, these patients had adopted sufficient retrieval strategies of their own and so could go on without a computer, which leads over to the use og computers as therapeutic devices.
4. *Therapeutic device.* Reports on the use of microcomputers as therapeutic devices for aphasics are abundant. Many refer to small programs used in a restricted number of cases. Among larger, more systematic projects only the following will be mentioned briefly. For detailed descriptions the reader is referred to the original publications.
   a. The series of treatment programs developed by Richard C. Katz, cited e.g. in Katz 1986 and 1987, the later publication being a co-called Clinical Forum with four additional outhors discussing the pros and cons of computer assisted aphasia treatment.
   b. The System for Training of Aphasic Patients, STAP, at the Delft University of Technology and the rehabilitation center De Hogstraat, Netherlands (Janssen & al., 1984).
   c. The West-German federal program Thera Voice (Stachowiack, 1987).
   d. The Finnish Language Enrichment Therapy – Computer Assisted Rehabilitation, LET-CAR, by Leena Salonen, Helsinki.
   e. Datorstödd språkträning för afatiker, DSSTA, by Alan Sheats, a project supported by the Swedish Aphasia Association (Sheats, 1987).

f. A series of programs by Gunnilstam, Farsta, Sweden (Gunnilstam, 1988).

An advantage of computer aided aphasia therapy is the increase of time patients can be engaged in treatment activities, as they do not need the continuous guidance of a professional therapist. Moreover, certain patients can be expected to benefit from the facility to get an unlimited number of test presentations from the computer or to engage in useful drills, which may seem too time consuming in ordinary therapy sessions. Therapy programs should always be devised to give an immediate feedback to the patient's test solutions. Thereby, it is easy also to get a computation of the total scores at the end of the therapy sessions. Such scores can be presented graphically and printed out as a protocol for the records.

To make optimal use of a computer, the patients' coputer aided activities should be well integrated in the ordinary treatment guided by the therapist. To this end it is necessary to develop individualized programs with each patient having his personal program disc to work with. At the same time the programs should be flexible enough to easily adapt the level of difficulty in different training items according to the personal, changing needs of the patients. No one but the therapist can be expected to take responsibility for the individualized formation and continuous adaptation of the programs. However, many therapists feel intimidated by their «computer illiteracy», they suffer from «cyberphobia». The «user friendliness» of a computer system for aphasia therapy therefore should be regarded from at least two aspects, *viz.* that of the therapist's system and that of the patient's (Stachowiak, 1987).

Most of the afore mentioned ongoing projects have been working for a number of years, elaborating original solutions of the involved problems which are anything but trivial. The pilot study to be presented here aimed at testing some ready made, recently generally available computer facilities and their applicability for aphasia therapy, *viz.* the Macintosh micorcomputer with a mouse control instead of a key board for the patient and the Hypercard system program, developed as an easily handled program control system, which could be suitable for the therapist.

PILOT STUDY

Material and methods

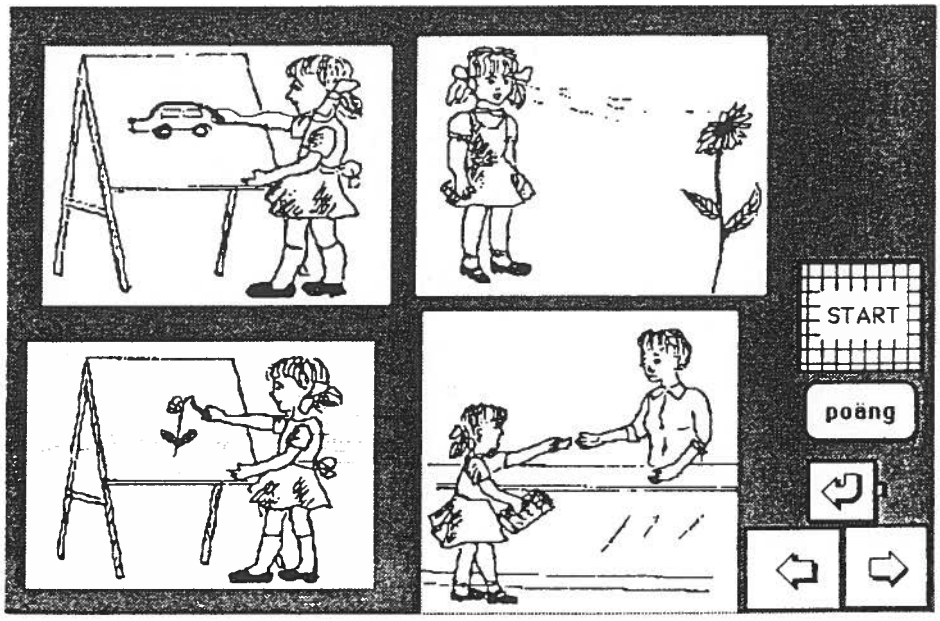
From a generally available training material for aphasics a number of black and white pictures were digitized and stored on floppy disc by aid of a scanner (Microtek MS-300 A). Some of the pictures illustrated common objects. Others rather described simple events. The pictures belonged together four and four, one depicting the target, the rest being aimed as distractors (Fig. 1). By aid of an audio digitizer (Impulse audio digitizer) stimulus words or sentences uttered by a male speaker were recorded and stored digitally.

To carry out the therapy program a Macintosh SE microcomputer with hard disk (storage capacity above 20 Mb) was chosen for several reasons. One was the facility to interact with the computer without a keyboard, which may be too complicated for aphasic and physically handicapped patients. Instead, the activities af the computer could be controlled with a «mouse». This is a small box, the size of a card deck, which is moved on the table in different directions and causes a cursor to move on the monitor screen of the computer. In this way the cursor can be placed on certain special areas of the screen, called «buttons», which can be activated by a short pressure on the mouse. Activation of a button causes the computer program to proceed in a previously determined way.

The second reason to chose the Macintosh technology was a newly available program called Hypercard. Hypercard permits the user to create his own buttons on the screen and to decide the activities of the computer when they are activated. This is done by some simple programming of the buttons in a specially developed language called «Hypertalk». The Hypertalk programming language is in its structure and vocabulary similar to an ordinary dialogue in English, which makes it suitable for easy interactive learning. Furthermore, each

FIGUR 1

Print out from monitor screen of one of the «pages». Auditory stimulus (in Swedish): "The girl is drawing a flower". For explanation of program functions see text.



button on the monitor screen can be given a characteristic appearance, either by special signs, by some text or by a picture.

The computer facilities described so far were used to develop a program for auditory-visual matching supposed to be a training of auditory comprehension. By activating the turn over buttons marked with straight arrows in the lower right corner of the monitor screen (Fig. 1), the patient can chose a certain «page» with four pictures. Activation of the «start» button makes the computer utter the stimulus word or sentence, the play back quality comparing to that from an ordinary cassette recorder. Activating one of the four picture buttons results in a written «right» or «wrong» message on the screen. When the patient wants to try another set of pictures, he can turn to another «page» by activating one of the turn over buttons, all «pages» forming a loop. The number of correct and wrong answers is shown whenever the tally button (Swedish: «poäng») is activated. The user can get out of the program by activating the exit button marked with a bowed arrow.

Patients

The training program was tested on four aphasic patients, one female and three males, all comparatively young (54–63 years) and active. Details of their aphasia symptoms are shown in table 1. All had suffered from left hemisphere cerebrovascular accidents between half a year and a year earlier and were in logopedic therapy.

Results

The only female patient had great difficulties in learning how to handle the mouse and in understanding the function of the program. Already after half an hour's trial she became so frustrated, that she did not want to continue practising with the computer, even if offered a more suitable program.

Subject number two was a vital and active man in the middle of his fifties with some disturbance of comprehension. Having some earlier experience of computers from his professional work as a post office clerk he learned to understand and to handle the computer program within five minutes. He found the quality of the acoustic stimulus and of the pictures on the monitor excellent and appreciated the opportunity to train his defect comprehension in his own pace independent from a therapist. Especially he appreciated the possibility of training in repeated short sessions, as prolonged sessions of therapy with a logopede tended to elicit his spells of severe headache.

Also subject number 3 had had some computer experience from his work in an assurance company. He learned to handle the program within 15 minutes but showed some persistent difficulties in changing «pages» to get a new exercise. This difficulty was felt more to be caused by lack of initiative than by mental or physical problems when handling the computer. In the exercise he often wanted a repetition of the acoustic cues from the computer. He found the computer aided training monotonous and boring and would not accept it as a complement to individualized therapy with a

TABLE I - PATIENTS

Subject	1.	2.	3.	4.
sex and age	female 63	male 54	male 56	male 63
site of lesion	frontal	parieto-occipital	fronto-temporal	fronto-temporal
aphasia syndrome	Broca	acoustico-gnostic semantic	Broca	Broca-global
degree of aphasia	moderate verbal amnesia and disturbance of comprehension, 1-word sentences	slight	moderate	considerable: scarce spontaneous speech, considerable disturbance of comprehension
physical state	right arm paresis	no paresis	right hand paresis	right hand paresis
mental state	moderately active	vital and active headaches	moderately active	moderately active
earlier computer experience	no	yes	yes	no
engaged in computer aided treatment	—	++	+—	++

logopede. What he wanted to practise was oral communication, not formalized items of language ability. In his work with the computer he never became independent but relied on explanations and other help from the logopede all the time.

The last subject needed only about 15 minutes to learn to handle the program in spite of his lack of earlier experience from computers. He showed a marked interest in the computer aided therapy and could work continuously with the program for as long as entire hours. The level of the exercises in our pilot program seemed just appropriate for his type of rather considerable language deficits.

Discussion

The experiences from this pilot study compare well with those reported elsewhere (e.g. Gunnilstam, 1988). Female patients are said to be more difficult to motivate for computerized treatment than males. Patients with extensive cerebral lesions especially with involvement of frontal areas of their brains may show too great a loss of own initiative to be able to engage in computer aided therapy independently from a therapist. On the other hand, younger and mentally active male patients, preferably with some earlier experience of computers, may accept computerized treatment with enthusiasm. An especially attractive feature seems to be the interactive quality of the training based on the immediate feedback from the computer. Negative feedback, i.e. the message that the patient's answer to an item was wrong, seems to be far more easily tolerated when emanating from the computer than from a therapist.

To conclude, our available standard equipment of a Macintosh microcomputer with Hypercard in combination with an optic scanner and an audio digitizer seemed to be most suitable tools to generate a functioning therapy program for aphasic patients. In future work we intend to develop a library of different therapeutic tasks with varying degrees of difficulty. Supervised by the therapist, special individualized combinations of such tasks could then be assembled as a patient's personal program to be integrated in and functioning as an expansion of his ordinary therapy.

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