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USE OF "THERAPIST-FRIENDLY" TOOLS IN COGNITIVE ASSISTIVE TECHNOLOGY AND TELEREHABILITATION

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ABSTRACT

A "therapist-friendly method of customizing cognitive assistive technology was used to help a patient with persistent cognitive, motor, and language deficits following a brain injury gain independence in specific priority activities. Prosthetic software was designed by a multidisciplinary team of clinicians and a computer programmer, enabling each intervention to match the specific abilities and deficits of the patient. Telerehabilitation technology and techniques were used to efficiently deliver all therapy and technical interventions in the patient's home. The results demonstrate a significant increase in functional independence for the patient after a minimal amount of training.

BACKGROUND

A characteristic of cognitive assistive technology is that it is highly customizable. That is most efficiently done if the therapist plays the major role in prosthetic software design. It must be customized to the specific abilities and deficits of the individual, focus on the patient's priority activities, be developed in the environment in which the activities will be performed, and be user-friendly to the patient (1). Additionally ongoing evaluation is necessary as the patient uses the technology in daily activities, making modifications as necessary (2).

Recently the delivery of therapeutic interventions at a distance using electronic means and remote monitoring of rehabilitative progress known as telerehabilitation has been recognized (3,4). A computer-based platform of telerehabilitation has been developed that enables cognitive assistive technology to be designed and implemented in a more efficient and successful manner than traditional forms of service delivery (5).

1. Simplified file access, save, and print commands for word processor to increase ability to create, access, modify, and print longer, detailed amounts of information.
2. Addition of speech synthesis function for same word processor to be used for phone call, with ability to easily select phrases of prepared text to be spoken in response to questions.
3. Addition of rolodex and envelope printing function to same word processor.

RESULTS

Relaying detailed information to his physicians during appointments

After two half-hour training sessions, SH was independent to add to and print a file that he titled "doctor information". Follow-up data revealed he modified and printed this document two times a month for his appointments. SH reported a significant increased his ability to communicate important information to his doctor. Later, he created 4 other files for similar purposes, which the data showed he regularly modified and printed in correlation with events on his calendar.

Calling to schedule rides

After two half-hour training sessions, SH was independent to use the Play function to make a phone call and schedule his transportation. In follow-up, the data report indicated he had to repeat sentences several times, a problem the patient did not recall. The therapist contacted the operator the following day, who revealed that the information was spoken too fast for her to write it all down the first time through. Modifications were made to the intervention that added pauses between phrases of information. Follow-up data indicates he has continued to make this phone call each week.

Communicating socially in greater depth with his friends

SH began using the file and print functions he learned to type letters to his friends, but was unable to address the envelopes. An envelope-printing function was added, which the therapist customized to SH's specific abilities and deficits. SH was proficient to use this program after one half-hour training session. Follow-up data after initiating this program indicated he sent 1-3 letters each week to friends.

DISCUSSION

Several key factors of this telerehabilitation and technology design method are thought to contribute to the success of this patient treatment. First, the telerehabilitation technology allowed the therapist to work with the patient in his own environment and focus on his high priority real-life activities as opposed to simulated activities in a clinical setting. Second, the data collection facilitated communication and acquisition of detailed information from the patient and enabled the therapist to be aware of the patient's activities as he used the technology throughout the day. Third, therapist-friendly tools promoted the collaboration between the clinicians and the programmer and enabled development of assistive technology specific to the patient's abilities and needs. This detailed level of customization ensured minimal training on the part of the patient to achieve proficiency. The result was development and implementation of assistive technology that significantly improved the patient's functional independence.

REFERENCES

1. Cole, Elliot (1999). "Cognitive prosthetics: an overview to a method of treatment".

METHOD

The Telerehabilitation Approach

Treatment sessions were conducted using a computer-based telerehabilitation method. The patient was provided with a personal computer and video-communications technology in his home. The therapist had a similar system with some additional software and networking capabilities. This platform is comprised of four components: 1) videoconferencing between the patient in his home and the therapist in her office; 2) remote computer connection, allowing the therapist to share the patient's home computer from her office; 3) data collection, providing the therapist with work products and detailed logs of the patient's use of the technology; and 4) an integrated treatment planning system that coordinates activities of the therapist, patient, and computer programmer.

A clinical team conducted 3 telerehabilitation treatment sessions per week with the patient. Treatment sessions generally focused use of the assistive technology to facilitate greater independence. When new features or applications were introduced to the patient, usability testing and training activities were also incorporated. In addition to direct treatment time, the occupational therapist reviewed patient work products and the patient's activities performed on the computer. As new features and applications were developed for the patient, the therapist also devoted time to design planning and testing sessions.

Patient Characteristics

SH is a 41-year-old man who sustained a severe brain injury three years ago. He underwent an extensive period of inpatient and outpatient therapy, when he was referred to this program he was no longer receiving therapy services. Residual deficits included verbal apraxia, left hemiplegia, right apraxia, and cognitive deficits in the areas of memory, sequencing, generalization, and problem-solving. A personal care attendant assisted him with dressing, bathing, and meal preparation. His mother, with whom he resided, managed all of SH's finances, appointment scheduling, and many health care management activities. SH maintained an active social life, travelling into the community using transportation services which were scheduled by his mother.

SH was not able to communicate through handwriting due to ataxia, but was able to type using a standard keyboard. He had a simple communication device, but due to cognitive deficits, was not proficient to use many of its features. He was able to type short phrases and have them spoken aloud, but he could not store and modify longer lengths of type.

Defining the Problem

After an initial evaluation, he was provided with a simplified word processor to record his thoughts and answers to the therapists' questions. Details about functional problems were acquired through review of the patient's journal, interview, and performance observation using videoconferencing. Three identified functional problems are the focus of this presentation.

1. Relaying detailed information to his physicians during medical appointments
2. Calling to schedule rides from handicapped transportation services
3. Communicating socially in greater depth with his friends

Designing the Intervention

The therapist has a toolkit for design and some implementation of prosthetic software. Some technical details are left to the programmer. Prosthetic software interventions aimed to enable independence in performing the activity in consideration of his specific abilities and deficits. Usability of the designed interventions with the patient was conducted by the therapist, during which suggestions from the patient are solicited. Interventions were modified based on results of usability testing and the patient's input. The interventions designed for this patient, relevant to the three functional problems listed above, were:

Neurorehabilitation, 12(1): 39-51.
2. White SM, Seckinger S, Doyle M, Strauss DL (1997). "Compensatory strategies for people with traumatic brain injury". *Neurorehabilitation*, 9:205-212.
3. Cole, Elliot, and Dehdashti, Parto (1998) "Computer-Based Cognitive Prosthetics" ASSETS 98 ACM Conference on Assistive Technologies, April 15-19, 1998 Proceedings. ACM Press.
4. Rosen, Michael (1999). "Telerehabilitation", *Neurorehabilitation*, 12(1):11-26.
5. Ziegmann, Michelle (1999). "Telerehabilitation: a technology-assisted method of providing cognitive rehabilitation". Presented at 17th Annual Great Southern Occupational Therapy Conference, Destin, FL.

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