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The Changing “Face” of Aphasia Therapy

Jaime B. Lee and

Center for Aphasia Research Rehabilitation Institute of Chicago, Chicago, IL

Leora R. Cherney

Center for Aphasia Research Rehabilitation Institute of Chicago, Northwestern University, Feinberg School of Medicine, Chicago, IL

Abstract

A growing literature suggests that with intensive treatment, individuals with chronic aphasia continue to demonstrate language recovery for years post stroke. For example, Bhogal and colleagues conducted a literature review which suggests that intensive speech language therapy delivered over a short period of time (average of 8.8 hours per week for 11.2 weeks) resulted in significant improvements, while lower-intensity therapy provided over a longer period of time (average of 2 hours per week over 22.9 weeks) did not result in positive change (Bhogal, Teasell, Speechley, & Albert, 2003). Similarly, the constraint induced aphasia therapy data emphasize the importance of massed-practice in the improvement of language skills of individuals with chronic aphasia (Pulvermuller et al., 2001; Maher et al., 2006). However, providing intensive treatment to individuals with chronic aphasia can be costly, and the current healthcare environment in the United States is one which does not recognize its value. As a result, clinicians and researchers in the field are left searching for cost effective ways to deliver aphasia treatment. One method of providing less costly but intensive treatment is via the computer.

Computers in Aphasia Treatment

A well documented body of literature supports the positive effects of computerized treatment for aphasia (Katz, 2001; Loverso, Prescott, & Selinger, 1992; Petheram, 2004). While many earlier computer-based therapy programs relied on pre-defined exercises that were fairly inflexible, more recent programs have been designed to allow specifically for treatment that is interactive and individualized to clients' needs. For example, Doesborgh and colleagues' MultiCue program engages the person with aphasia by allowing him or her to experience different cueing strategies for naming and to evaluate which are most useful (Doesborgh et al, 2004). Recent technological advances also allow treatment to be tailored to individuals' needs and delivered remotely. For example, a system developed by Mortley, Wade, and Enderby (2004) permits the person with aphasia to practice exercises independently on their home computer and receive modifications to the program materials via the Internet. After the initial installation of a computer in the client's home, subsequent visits by the speech-language pathologist were not needed.

Pederson, Vinter and Olsen (2001) also suggest that computer therapy, like traditional speech therapy, must be individualized in order to be effective. At the same time, the degree to which the individual with aphasia can utilize the program independently is an important consideration. They write: “It is inevitable that the therapist must spend some time individualizing the program, but the mechanism for this should be so user-friendly that the time devoted to it is very small compared to the amount of time the patient may subsequently work unsupervised with the program” (p. 153).

The purpose of this article is two-fold. First, we describe a unique, interactive computer software program developed for individuals with aphasia to practice conversations that have been individually scripted for them (Cherney, Halper, Holland, & Cole, 2008; Cherney et al., 2007). In this program, AphasiaScripts™, an avatar serves as the virtual speech-language pathologist or conversational partner (see Figure 1). The simplicity of the user interface allows the person with aphasia to quickly learn to use the program and to manage the level of supportive cueing. The second is to clarify the role of the speech-language pathologist in the light of new technology that allows a person with aphasia to practice conversations intensively and independently. AphasiaScripts™ serves as an example of a software program that makes use of advanced computer technology, yet still requires the clinical expertise of the speech-language pathologist.

AphasiaScripts™

A study evaluating AphasiaScripts™ is currently underway at the Rehabilitation Institute of Chicago's *Center for Aphasia Research*. The AphasiaScripts™ software program uses an animated agent with visible speech to provide the conversational script training for individuals with aphasia. The virtual therapist, developed with the *Center for Spoken Language Research* (CSLR) at the University of Colorado, serves as the conversational partner and is programmed to produce natural speech with correct movements of the speech articulators. We have affectionately called the avatar "PAT" (Personal Animated Therapist) (Cherney et al., 2008).

The AphasiaScripts™ software features two components, a user or "player" part which interfaces with the person with aphasia and an authoring or "editor" piece. The authoring component is used by the clinician to create and generate scripts that are then matched to a specific person with aphasia (user). Each script is typed into the program and recorded by the clinician. After a line of the script is recorded, the program aligns each spoken word with its corresponding written word. Occasionally, the clinician may need to use the pronunciation feature of the editor program to write out words that are not recognized by the system. For example, a date can appear in the written script as "2007", but has to be transcribed with the pronunciation feature as "two thousand and seven" in order for the animated agent's speech to align with the written date when the user views the script. The editor program also allows for both the pause time between sentences and the total time allotted for utterances to be adjusted according to the user's needs.

AphasiaScripts™ allows for repetitive practice of pre-recorded individualized scripts with varying degrees of support to the user. The player interface has three components: first, the user listens silently to the whole conversation; second the user practices each sentence of the conversation repeatedly; and third, the entire conversation is rehearsed in turn-taking with the virtual therapist. During sentence practice, users are provided with various forms of assistance including highlighting the written word, observing the virtual therapist's corresponding oral motor movements, and speaking the sentence in a choral manner. The person with aphasia also has an opportunity to play back and listen to his or her utterances recorded by the computer. Within the sentence level practice, users can also practice individual words.

The conversation practice is also carried out with varying degrees of support provided by the animated virtual therapist. "Maximum support includes the written sentence with each word highlighted as it is spoken by the animated agent. Cues are faded over time—the animated agent's voice, the written word, and movement of the articulators—according to individual

needs” (Cherney et al., 2008, p. 3). As the person with aphasia masters the script, he or she can remove all of the cues and practice with the animated agent as in real conversation.

The AphasiaScripts™ player interface offers those with aphasia control over their own practice sessions. Users can choose to practice individual words, sentences, or their entire conversational script as often as they wish. They can plan and track practice time with a visual timer in the bottom corner of the screen; in addition, the program can be paused at any time to allow for short breaks.

Although the AphasiaScripts™ program requires some initial training with users, especially those without basic computer skills, it is quite simple and has been easily operated by most of the individuals with aphasia who have participated in the study. Automatization of script production requires cued massed practice, an often time consuming, laborious process when provided by a speech-language pathologist. When provided by a computer, utilizing a program specifically designed for the person with aphasia to independently reduce cues, the clinician’s time and resources can be spent elsewhere.

Theoretical Foundation for AphasiaScripts™

Script learning is based on Logan’s (1988) instance theory of automatization, where skills that are practiced as complete, context-bound performances are more likely to become quickly accessible, effortless, stereotypic and unconscious (Logan, 1988). When stimuli are mapped consistently and frequently onto the same responses, retrieval occurs automatically if the same stimuli from the practice environment are present. The speed and amount of retrieval increases with practice.

Script training emphasizes language used in personally relevant situations. Individuals with aphasia are good candidates for script training. Research has shown that script knowledge is not seriously compromised by mild to moderate aphasia (Armus, Brookshire, & Nicholas, 1989; Lojcek-Osiejuk, 1996), and scripts can be learned successfully by individuals with aphasia (Youmans, Holland, Munoz, & Bourgeois, 2005).

Role of the Clinician: Script Development

Although computer therapy provides a medium for clients with aphasia to practice independently in their homes, it does not negate or replace the role of the qualified clinician. In AphasiaScripts™, the clinician plays a fundamental role in the processes of script development and individualization of scripts for each person with aphasia. The development of a script requires not only identification of the individual’s communication needs, but also careful consideration of his or her interests and relevant scripting topics. A clinician with strong listening skills and a repertoire of supported conversation techniques is critical to eliciting information that may become relevant for script development from individuals with severe communication deficits.

Prior to starting AphasiaScripts™, the client, often accompanied by family members or caregivers, meets with the clinician to identify potential topics for the scripts. Scripts may be a monologue, a dialogue in which the person with aphasia is the initiator and/or a dialogue in which the person with aphasia is the responder. For purposes of the research study, we developed one of each of these three scripts, yet for clinical purposes, any type or number of scripts could be developed. The clinician may ask the client to think about situations in which he or she would like to communicate better. The clinician may also find it helpful to provide “an activities checklist” to clients to identify situations and activities in which he or she currently participate and those which he or she would like to participate. For example, a

client may indicate that she enjoys shopping and wants to be able to talk with salespeople in stores in the future. Given that the client's language impairment is preventing her from participation in a socially relevant activity, the clinician could explore ways for the client to feel more prepared for communication through a shopping script. (see Figure 2 - generic shopping script).

Often the most powerful scripts are self-chosen stories about events in one's life. Most of the participants in AphasiaScripts™ have chosen to tell their stroke story as their monologue script. They want to be able to share their experience and tell people about aphasia. The next most common scripts are those focused on resuming simple conversational roles, like getting to know someone new at a party or visiting with friends and relatives. Other popular topics among AphasiaScripts™ participants have included: ordering a meal in a restaurant, talking to grandchildren, asking a salesclerk for help, and ordering a pizza for delivery. More important than the topic itself is its relevance and usefulness in participants' lives and frequently encountered situations.

The process of script development with a client is interactive. Some individuals with aphasia may be able to identify script topics and guide the writing independently while others require extra support. Script development may take place over several sessions, as the client reviews drafts and recommends changes. In order for a script to be meaningful, it is essential that the person with aphasia feels it is written as he or she would have previously spoken it and not in the clinician's voice. Script writing can be a creative, rewarding process for both the clinician and the client, who is given a medium for expressing an untold story. One client who participated in the AphasiaScripts™ research study wanted her monologue script to incorporate talking about her family and her interest in art, a hobby that she had not pursued since her stroke. The clinician encouraged her to bring in family photos, and together they drew a family tree. It shortly became clear that the story of her family and her love for art were intertwined.

I've loved art since I was a little girl.

It runs in the family.

My grandfather owned an art gallery.

His name was _____.

My father, _____, worked in the gallery.

I took my first art class when I was eleven years old.

I minored in art in college.

My favorite style is abstract art.

After my stroke, I stopped painting.

I want to start painting again soon.

Through this script, she was also able to express an interest in returning to art, a hobby she has since resumed. An exit interview was conducted at the end of the research study in which the research clinician, the client (PWA) and her caregiver discussed the significance of this script. In the following excerpt, the PWA describes feeling *connected* to her family who had all passed away. The script practice provided an opportunity for reminiscence and a means to express a story that, most likely, had not been shared since her stroke.

CLINICIAN: What was it about the third script that you liked? ...Was it more being able to talk about your father and your grandfather, or was it about the art?

PWA: well/ the art yes/ but um// I don't know anymore/ all gone/ you know and/ and looking back/ my father/ my grandfather um/ with art/ takes is a little/ x before I gone I still um/

CAREGIVER: you feel very close with them...all your family is gone

PWA: well close to them/ but all of them

CAREGIVER: and talking about that...learning all the time... it makes her feel very

PWA: connected

CLINICIAN: and it's something you hadn't talked about in a very long time

PWA: never/ well a long long long long long time

CLINICIAN: that's great/ I'm so happy we wrote that together

Role of the Clinician: Script Mechanics

The clinician is responsible for establishing the appropriate script length for each client. Scripts can be up to ten conversational turns or twenty lines for monologue scripts. The degree to which an individual's production is impaired guides the length of each conversational turn, while his or her comprehension deficit helps determine the number of turns or the total length of the conversation. For example, an individual with more severe apraxia of speech but relatively good auditory comprehension skills may have an eight to ten turn conversational script, but with the length of each turn limited to approximately three words. Because the focus of AphasiaScripts™ is providing the client with optimal opportunity for verbal output, the virtual therapist's turn is kept brief, regardless of whether she is the initiator or the responder. For example, Pat (Personal Animated Therapist) often asks: "What else?" to elicit more information on a previously established topic from the client's next conversational turn.

The clinician must also consider word type and grammatical complexity across scripts. For the AphasiaScripts™ research study, each participant's three scripts were coded for the number of nouns, verbs, and modifiers. Grammatical complexity was determined by counting the number of morphemes in phrases and sentences and establishing a complexity index based on the mean length of morphemes per utterance. Next, the clinician matched the three scripts for word type and complexity, based on criteria developed for the research protocol. For example, the total number of words in each script must be within 90% of one another, while the number of nouns and verbs must be within five. In clinical practice, it would also be relevant to match scripts according to length and complexity to ensure consistency and, as the client improves, to modify each parameter accordingly.

The clinician plays a critical role in vocabulary selection for clients' scripts. In addition to drawing on vocabulary that is of high interest to the patient, it is valuable to include words and phrases that have the potential for frequent use by the patient and generalization to other conversational situations. Additional word selection consideration may include: word length, phonemic complexity, familiarity, and concrete versus abstract word types. Conversational openers and phrases that generalize to many conversational situations may have a tremendous impact for users who master them through script training. For example, one client wanted to incorporate a line that expressed interest in his friends he saw weekly at the gym. Together, the clinician and client agreed on the line: "What's new with you?" The client and his wife reported later that he not only used "What's new with you?" with his friends at the gym, but also initiated conversation with unfamiliar people at a Christmas party several weeks after he completed the study. Although this particular gentleman's

stroke was more than eight years previous, all of which time he had participated in speech-language therapy and multiple aphasia research studies, his ability to master a highly usable conversational starter via the AphasiaScripts™ program had a remarkable impact on his confidence and social interaction.

Lastly, the clinician is responsible for recording the client's scripts into the AphasiaScripts™ software. As previously mentioned, the editor interface of the software provides the mechanism to do so. The clinician must establish the appropriate rate and intonation for each user without compromising natural sounding conversational speech. In addition, the clinician is responsible for monitoring the client's progress throughout his or her practice to determine whether a script needs to be re-recorded at a faster or slower rate.

Conclusion

AphasiaScripts™ is an example of a computerized therapy program that utilizes both the expertise of a clinician and the technology afforded by its software to deliver unique, individualized conversational script training to individuals with aphasia. The clinician plays a critical role in the development of personalized conversational scripts, the consideration of script mechanics, and the operation of the authoring components of the software, while the computer provides the intensive, cued massed practice required for automatization and script learning, a laborious and time-consuming process when provided by a therapist. As computer technology becomes more accessible and researchers and clinicians continue to explore the utilization and benefit of computerized treatments in clinical practice, the virtual therapist may soon become a familiar face. Yet, computer therapy, even when practiced by individuals with aphasia independently in their homes, does not negate or diminish the importance of the experienced practitioner. On the contrary, clinicians may find themselves in the unique position of having the time and resources to carefully plan and administer creative, skillful treatment to their much deserving clients.

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Figure 1.
AphasiaScripts Player Interface Showing the Virtual Therapist

Pat: Can I help you?

You: I'm looking for a sweater.

Pat: We have some nice wool sweaters.

You: Wool is itchy. Do you have any cotton sweaters?

Pat: What size do you need?

You: I wear a medium. I prefer V-necks.

Pat: Here's one in blue or black

You: Great. I like the blue one.

Pat: Should I ring it up?

You: I'd like to try it on before I buy it. How much is it?

Pat: \$45

You: Where's the dressing room?

Pat: This way. Do you need anything else?

You: I need a pair of comfortable leather shoes.

Pat: The shoe department is upstairs.

You: Thank you for your help.

Figure 2.
Example of Script for Shopping