Best Practices for Incorporating Non-Aphasia-Specific Apps into Therapy

Gail Ramsberger, Sc.D., CCC-SLP, BC-ANCDS[1,2] and Paula Messamer, M.A.[1]

ABSTRACT

Given the proliferation of tablets and smartphones, there is a rising desire to use these technologies and apps in clinical practice. This article offers best-practice guidelines for integrating apps into aphasia rehabilitation. In concert with evidence-based practice guidelines, it describes the steps for deciding which apps to consider and how to judge their appropriateness. We recommend a process for selecting apps that involves three stages. The first step is no different than that used in traditional treatment planning. It involves assessing the client's speech and language, selecting the focus of treatment, and identifying evidence-based approaches to addressing this focus. When technology is being considered, however, it is also necessary to assess sensory, motor, and cognitive requirements of the apps and hardware being considered, as well as the client's ability to operate this technology. Finally, the clinician must consider hardware and Internet demands of the app and whether these are accessible to the client. We illustrate the process through a description of three cases for which we used apps that were not specifically designed for aphasia to deliver evidence-based treatments.

KEYWORDS: Aphasia, therapy, treatment, technology, apps, applications

Learning Outcomes: As a result of this activity, the reader will be able to (1) explain the steps that should be taken when selecting technology/apps to be used in treatment; (2) discuss motor, sensory, and cognitive skills that should be assessed when considering the use of technology; and (3) discuss examples of how apps not specifically designed for aphasia therapy were successfully integrated into the treatment plans for the three cases presented in the article.

[1]Department of Speech, Language, and Hearing Sciences; [2]Institute of Cognitive Sciences, University of Colorado, Boulder, Colorado.

Address for correspondence: Gail Ramsberger, Sc.D., CCC-SLP, BC-ANCDS, Department of Speech, Language, and Hearing Sciences, University of Colorado, UCB 409, Boulder, CO 80309-0409 (e-mail: Gail.Ramsberger@colorado.edu).

iRehab: Incorporating iPads and Other Tablets in Aphasia Treatment; Guest Editor, Jacquie Kurland, Ph.D., CCC-SLP

Semin Speech Lang 2014;35:17–24.
DOI: http://dx.doi.org/10.1055/s-0033-1362992.
ISSN 0734-0478.

It is hard to believe that it was only 7 years ago (2007) that smart tablet and smartphone technology became possible for the masses. Today, more than a billion people are using these devices,[1] and half of all computing devices sold are mobile.[2] This has resulted in a cultural shift from computers that run a small set of large software packages (Word and Excel [Microsoft Corp., Redmond, WA], etc.) to computers that move with us and hold tens if not hundreds of individually selected applications. Consequently, what is on one person's smartphone is quite different from what is on the phone of the person sitting next to them. The popularity of smart devices is mainly due to the proliferation of apps that provide useful tools and appealing forms of entertainment. There are apps for just about every purpose imaginable. The Apple iTunes App Store alone (which only sells apps for iOS devices such as iPads, iPhones, and iPod touches [all Apple Inc., Cupertino, CA]) reached the 50 billion downloads milestone in 2013.[3] With the addition of downloads for Android (Google Inc., Mountain View, CA) devices, the actual number of downloaded apps more than doubles.[4,5]

There is a considerable history in the aphasia literature about the use of software applications that run on personal computers and subscription-based Web site services, but these applications have not been recreated as apps on smart devices.[6–8] Many of the available apps contain tasks that could be used for treatment but are too childish to place in front of adult clients.[9] There are small numbers of adult-focused apps for aphasia rehabilitation but these generally offer a limited variety of treatment activities—for example, Tactus Therapy Solutions (Tactus, Vancouver, BC) (tactustherapy.com), Lingraphica, (Lingraphica, Princeton, NJ) (www.aphasia.com), and Virtual Speech Center (Virtual Speech Center, Burbank, CA) (www.virtualspeechcenter.com). These apps are fairly easy to find using any Web search engine (with the search terms "aphasia" and "treatment") or blogs and Web sites created by speech-language pathologists.

Not to be ignored are the huge number of apps that, although not specifically designed for aphasia rehabilitation, offer unique options for the development of treatments. These apps are generally inexpensive (if not free) and publically available. They often have greater flexibility in terms of multipurpose utilization in therapy, although successful integration into a treatment program may require a bit more creativity on the part of the speech-language pathologist. In the three cases that follow, we will illustrate how we have used this kind of app in the development of treatments.

Our approach is rooted in the desire to find ways to integrate technology into therapy so that the treatment plan drives the decisions about which app is used rather than the app driving treatment. Our approach treats technology as a tool to enhance treatment, especially in situations where independent therapeutic practice is a goal. We choose apps only after (1) careful assessment of the client and the app, (2) selection of a functional treatment focus and desired outcomes, and (3) analysis of the evidence to support specific treatment approaches and tasks (Fig. 1). For an app to be incorporated into a treatment plan, it must be able to meet the therapy task requirements and be usable by the patient in terms of both his or her nonlinguistic capabilities and hardware (and sometimes Internet) availability.

This approach requires clinicians to stay current on evidence-based treatment approaches and be well informed about the constantly changing new technology options available to them. Knowledge of technology and apps builds across time; we never truly approach a given client with a tabula rasa of ideas about which apps to use. Still, our point is that the decision about treatment approach should serve as a filter through which apps are passed for each client, each time. The patient's cognitive and motor capabilities should work as yet another filter for selecting apps. Some clinicians will stay abreast of developments in both arenas; however, we use a "technology consultant" model. Our technology consultant monitors and tests apps with the needs of the user in mind and works with the speech-language pathologist on finding good matches between treatment approach and app functionality. Technology consultants may come from a wide variety of nonclinical or clinical disciplines including assistive technology, rehabilitation engineering, computer science, psychology, speech-language pathology, or occupational therapy. Regardless of their discipline, they need to have an understanding of the

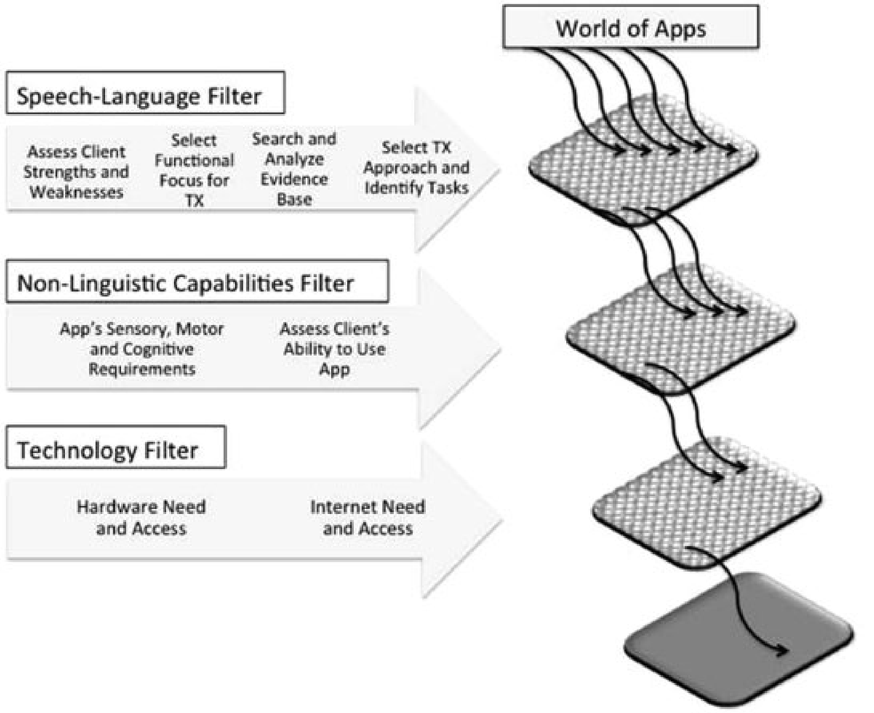

Figure 1 Recommended process for integrating technology/apps into aphasia treatment.

speech-language, motor, sensory, and cognitive functions most likely to be encountered when consulting on cases with specific diagnoses. This model already is widely utilized in the field of augmentative and alternative communication, and we see a growing need for a similar model in others areas of speech-language pathology, including aphasia rehabilitation.

Determining the usability of technology is comparable to the capability assessment in the augmentative and alternative communication world.[10] This involves determining the patient's sensory, motor, and cognitive capabilities in light of the demands of both technology devices and apps. For example, many free apps have pop-up ads that are problematic for a patient who is easily distracted by extraneous visual stimuli. Other apps require the user to swipe the screen and this may be difficult for a patient with motor impairments that impact the use of the arms and hands. The decision to use a tablet or a smartphone may depend upon visual acuity and/or the fine motor skills needed to use the keyboard. A full list of considerations is far too extensive to summarize here. We suggest that you choose a few simple apps and observe clients using them. One great app for quick evaluation of device use is Bitsboard (free and pro versions $2.99; grasshopperapps.com). The paid version includes numerous games each requiring different skills. Observe the client touching and swiping the screen and observe whether he or she is able to adapt when given additional guidance. For example, we worked with one client who had a continual problem with pressing the screen as if it was pressure sensitive. This continued despite multiple explanations and demonstrations. We were able to provide him with apps that required tapping but he could not master the distinction between touching and swiping.

The following cases are offered as examples of how we apply these concepts in aphasia rehabilitation.

CASE 1: ANNE

Anne was 33-years-old and 9 years postonset of aphasia subsequent to a left cerebrovascular accident (CVA) when we worked with her in our laboratory. She presented with a nonfluent aphasia of moderate severity with a Western Aphasia Battery (WAB) aphasia quotient of 75.2. Auditory comprehension was stronger than spoken output and written language was poorer than spoken although she was readily able to identify many of her written language errors. In addition to her aphasia, Anne was hemiparetic on the right side with greater involvement of her arm than leg. She ambulated with a foot brace and used her hemiparetic arm only occasionally for tasks such as holding a paper on the table as she wrote with her left hand. She was able to use her nondominant left hand for most functional activities (e.g., using utensils for eating, writing, cutting, etc.), although these movements were slower and less precise than would have been observed prior to her stroke with her dominant hand. She had no dysarthria or limb apraxia, but she did exhibit mild apraxia of speech. She passed hearing and vision screenings and reported no premorbid speech, language, hearing, or learning disabilities.

We interviewed Anne and her family and learned that she lived with her parents and two preteen children. Her family encouraged independence appropriately and she reported no issues related to mood. She enjoyed family activities, shopping, and cooking and was very motivated to explore possible use of technology to enhance her communication skills, especially distance communication with her children and friends. Anne expressed a specific interest in being able to use e-mail, social media, and texting.

At the conclusion of the evaluation and interview, the following had been established:

- Strengths: good auditory comprehension, good error awareness, clear articulation, better spoken output than written output, good procedural memory, enthusiasm, and strong support system
- Weaknesses: poor written language skills, apraxia of speech
- Treatment focus/desired outcome: the ability to use social media for distant communication with friends and family

We hypothesized that we might be able to leverage Anne's spoken language strengths and error awareness skills to improve her written output, thus enabling her to write short text and e-mail messages. The aphasia treatment evidence tables on the Academy of Neurogenic Communication Disorders and Sciences (ANCDS) Web site are always the first place we search for research to support selection of a treatment approach.[12] Unfortunately we found no studies to support this idea, but a PubMed search using the search terms "voice recognition software" and "aphasia" yielded one study that provided level III (weak) evidence supporting our treatment idea.[13,14] The case study involved a patient with fluent aphasia, but the approach of using voice-to-text software resulted in remarkable improvements in written language for this patient, and the authors suggested that other people with aphasia and writing difficulties might also benefit from this approach.

From a technology perspective, Anne had regular access to Wi-Fi, an iPad, and a desktop computer with a mouse. She previously had used the desktop computer for clinician-directed teletherapy and self-administered aphasia therapy software but was not using any technology at the beginning of our work together. Because she had no direct experience with an iPad, we asked her to complete some basic operations to determine if there were any limitations more specific to a touch screen interface. For example, with limb apraxia, some clients have a tendency to allow an unintended finger to touch the screen as they make a selection. This can often be avoided though the use of a stylus. Limited hearing can also be a factor because the speakers are not particularly loud, can be occluded by cases, and lack range and clarity when set to high levels. Cognitive issues may also interfere with the learning of steps to access and use an application. In Anne's case, she learned how to touch the screen, turn on and reawaken the iPad, and work through the steps to use a variety of apps after only a few minutes of instruction.

To summarize, our technology evaluation indicated that Anne had the motor, sensory, and cognitive capabilities to operate a smartphone, tablet, and/or a desktop computer as long as the device could be set down during use and operated with a single (nondominant) hand. Her speech was clearly articulated without distortion, increasing the likelihood that she would be able to use a speech recognition system.

We then turned to our technology consultant to identify iPad technology and apps that would allow Anne to access social media using speech recognition. Ultimately, we decided to explore the possibility of Anne using speech-to-text software (Dragon Dictation; Nuance Communication, Inc., Burlington, MA) to create a written draft that she could subsequently edit using the same procedure. We were encouraged by the fact that Bruce and colleagues had also used Dragon Dictation successfully with their client.[11] Using the speech-to-text plus editing approach, Ann spoke whatever part of the message she was able to orally produce. This typically consisted of several words that were part of what would ultimately become a complete sentence. She then studied the text she had produced, selected words that were incorrect, and made a second attempt on producing just those words. This process was repeated until she was satisfied with what she had generated in text. She then could expand the utterance or begin a new one. It took only two sessions to achieve a basic level of competence in using this approach, thanks to Anne's strong procedural memory skills.

We then assisted in the creation of Anne's Gmail account and a list of contacts for e-mail and text messaging. We also showed Anne how to take photos using the iPad and add these to e-mail and text messages. Fig. 2 shows a sample of Anne's spoken language skills and one of the e-mail messages she sent to us using the speech-to-text plus editing approach.

Admittedly, this e-mail message took Anne several hours to generate. However, the sense of satisfaction she got from producing e-mail messages of this quality far outweighed her perceived effort. Having observed the success of this approach, we now want to shift our focus to enhancing the quality of messages Anne produces so that she can write several sentences that more fully develop an idea.

CASE 2: GERALDO

Geraldo graduated from high school only months before sustaining a traumatic brain injury as a result of falling from a slowly moving car. He received acute medical care that included a craniotomy to evacuate a left hemisphere hematoma and a tracheostomy due to breathing difficulty. He then was transferred for inpatient rehabilitation and was approximately 1 year postonset when he was seen in our laboratory. At that time, he presented with severe Broca-like aphasia with a WAB aphasia quotient of 16.2. He had recently completed Melodic Intonation Therapy and was subsequently able to produce a small set of commonly used two-to-three-word phrases.[15] Geraldo's auditory comprehension was a relative strength and his reading and writing were more impaired than speaking and listening. He lived at home with his parents and siblings, who provided strong supports. Prior to his accident, Geraldo's primary leisure time activities were playing sports and weight lifting and he had recently been able to return to the gym to work out.

At the conclusion of the evaluation and interview, the following had been established:

- Strengths: relatively good auditory comprehension, enthusiasm for technology, and strong family support system
- Weaknesses: concomitant nonlinguistic cognitive impairments, poor written language skills, apraxia of speech
- Treatment focus/desired outcome: increased quantity and quality of spoken language

The ANCDS treatment evidence tables include several studies that report on the effects of script training for patients with nonfluent aphasia.[12,16–18] A key step in this treatment approach is practice listening and then repeating spoken utterances. Although script training involves practicing utterances within the functional context of a conversation, it is generally applied to patients with more spoken language than Geraldo. We, therefore, decided to try listening and repeating meaningful, personally relevant spoken utterances as an intermediary step between Melodic Intonation Therapy and full-blown script training.

From a technology perspective, Geraldo had access to an iPad and he regularly played games using a Microsoft Xbox. Geraldo had no difficulty holding the iPad, opening the cover, and launching applications. His strong vision and hearing allowed for the selection of

Transcript of Spoken Cinderella Story	Email Generated Using Speech-to-Text + Editing Method
Once upon a time Cinderella and he died. Stepmother really mean. The cats really nasty. Then Cinderella chores and two girls really nasty then piece of paper the ball piece of paper the ball then the rats the rats the birds new dress surprise then put on your dress pearls and really Cinderella rip it off and then outside outside the house fairy fairy godmother godmother new outfit the horse and coach pumpkin and mice then in the ball the music Cinderella and Prince Charming danced together then midnight Cinderella one shoe left no one shoe left. Then midnight the pumpkin the horse and the dog. Next day the prince Cinderella one shoe three people try it on then doesn't fit then Cinderella fits then then the prince and Cinderella happily ever after.	Hi Paula, I am so excited to get my iPad soon! Over the weekend Katy and Melissa went to a Halloween party. Here are some pictures of the girls! Anne 

Figure 2 Spoken language sample and e-mail message Anne wrote using the speech-to-text plus editing approach.

applications that rely on sound and/or visual input and did not necessitate the use of a headset or larger screen device. Based on this, we judged him as having sufficient sensory and motor skills to use many iPad apps.

With respect to cognitive status, Geraldo's ability to acquire task set and maintain attention were reduced. For this reason, we felt it was important to find an application that led him to the task in a sequential fashion and did not require hopping around across different screens and settings. His limited reading skills implied that the applications must either not involve large amounts of text and/or provide auditory instruction.

We chose to use the Little Story Maker app (Grasshopper Manufacture, Inc., Suginami, Tokyo, Japan) (free, grasshopperapps.com) to depict common phrases that Geraldo would use in everyday conversations. Although intended for use with children, this app is not overly childlike in appearance. We incorporated pictures and recordings in Geraldo's own voice. We asked him to play the sentence then repeat it back multiple times before continuing to the next image. The app does not have ads and the design is uncluttered.

Geraldo was successful at using the app during therapy and participated in deciding which phrases to include, how to word them, and which pictures to use to represent the concepts. He did not use the application as part of home practice. We suspect this happened because of his diminished self-initiation skills and because the activity was not sufficiently engaging. In summary, the application supported audio cuing of personally chosen and functionally relevant target phrases within therapy sessions with the speech-language pathologist. In the future, we hope to identify an app that supports both audio and visual (video) modeling (over audio alone) because there is some evidence to suggest this may be more effective for patients with Broca's aphasia.[19]

CASE 3: BOB

When we worked with Bob he was 79-years-old and 3 years post–left CVA that resulted in severe Wernicke aphasia. He had no hemiparesis, dysarthria, or apraxia (limb, buccofacial, or speech), and he passed both hearing and vision screenings. He was uncooperative with efforts at formal assessment, but we were able to determine through informal means that his ability to read was significantly better than his auditory comprehension. His spoken output was often decipherable despite many verbal paraphasias and paragrammatic errors. He exhibited an excessive press of speech in which he would talk at the same time as his conversational partner and dominate the conversation in terms of turn taking. This, combined with a loud voice, a large physique, and full mobility, resulted in an overbearing presence that we were confident contributed to his being socially isolated in his assisted living facility. He clearly let us know that he felt lonely and he expressed a strong desire for greater social connections. He was not willing to engage in structured therapy tasks, but was highly motivated to participate in conversations about current events and sports.

At the conclusion of our informal evaluation, the following had been established:

- Strengths: reading comprehension, spoken output was decipherable if the topic was known to the listener, motivated to talk with people and has many things to say, had learned to use a computer since his stroke, and was able to stay current on local/national/international events and sports by reading *USA Today* and watching TV
- Weaknesses: poor auditory comprehension, severe press of speech, overwhelming presence, very difficult for others to carry on a conversation with him, extremely resistive to anything that is childlike or beneath his perceived level of intelligence
- Treatment focus/desired outcome: improve Bob's ability to engage in satisfying conversations to lessen his feelings of isolation

Given the dearth of evidence for treatment of auditory comprehension in Wernicke aphasia and the fact that Bob was not receptive to the types of tasks that might comprise a traditional restorative therapy approach, we decided to take a compensatory approach instead. We had observed in our informal assessment that augmenting spoken language with the corresponding written words was extremely effective in enhancing his comprehension and subsequently allowing him to better engage in a conversation. Although we found no evidence in the literature to back up this approach, we did find support for the idea when we consulted with several experienced aphasia therapists. The challenges to successful implementation of this approach were that Bob quickly grew impatient when we stopped to write, and, under pressure to keep the conversation moving, we were limited to writing a few key words that were often insufficient to cue his understanding.

From a technology perspective, Bob had acquired a basic understanding of a Windows laptop computer (with a touch pad, no mouse) since his stroke, but his use was limited to playing solitaire. Although Bob's vision and hearing were normal, he interpreted his lack of auditory comprehension as being due to hearing issues and frequently attempted to turn up the volume. His intact motor skills allowed him to hold a 7-inch mobile device with a single hand and to open and operate it using the touch screen without a stylus. Bob's press of speech made it difficult to get him to engage with the device while someone was present. From this, we decided that his conversational partner would need to be the person who drove the use of the device.

Combined with treatment goals of improved conversations, we chose an Android application called Notepad Pro (Alibaba.com, China) (U.S. $1.99 in Google Play Store). This app was particularly appropriate because it supported larger fonts, put each utterance on a separate line, had simple to use controls, and had an uncluttered screen. There is a free "lite" version of the App with more limited functionality but, because it displayed ads, we chose to purchase the full version. During use, the conversation partner would tap the microphone icon, speak into the device, and then show Bob the screen. Bob would read the screen and respond orally. Sometimes the partner needed to firmly enforce the reading of the screen as Bob would respond to what he heard as the conversation partner spoke into the device. We found that the conversational exchanges were more complete and balanced because the use of the device forced better turn taking and allowed the conversation partner to complete a full thought before relinquishing a turn.

CONCLUSION

Clinical practice is benefiting from the use of smart technologies and apps. This article presents best-practice guidelines for integrating apps in aphasia rehabilitation. It extends evidence-based practice guidelines with recommended steps for determining which apps are appropriate given the sensory, motor, and cognitive capacities of the individual client. The app selection process involves a series of filters beginning with assessment of the client's speech and language, selection of treatment focus, and identification of evidenced-based approaches and selection of treatment approach. Next, potential apps are assessed in terms of sensory, motor, and cognitive requirements and the client's ability to use the app. Finally, apps that meet the speech-language and nonlinguistic capabilities parameters must be assessed in terms of hardware and Internet demands and availability. We describe our use of a technology consultant and our three cases provide detailed examples of how apps that were not specifically designed for aphasia can be effectively used to deliver evidence-based treatments. We demonstrate the importance of finding ways to integrate technology into therapy without the app driving the treatment.

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