

**NORTHERN ILLINOIS UNIVERSITY**

Can a computerized reading therapy protocol augment auditory  
comprehension in severe aphasia?

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**By**

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Capstone Approval Page

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Can a computerized reading therapy  
protocol augment auditory comprehension  
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## **Abstract**

Treatment of severe aphasia has historically been very difficult to remediate, and efficacious treatment options for this type of aphasia are limited (Sarno et al., 1970). A person with aphasia demonstrates impairment in the understanding of and expression of oral language. Also, due to the multi-modal nature of aphasia, an individual with aphasia will usually demonstrate impairment in reading abilities as well. The purpose of this study was to determine whether or not a computerized reading therapy program could augment auditory comprehension. Utilizing a single-subject, ABA design, we evaluated the effects of computerized ORLA (Cherney, 2010) on an individual with severe aphasia. Qualitative results yielded improvements in both auditory comprehension and verbal expression, as well as gains in confidence within the subject. Failure to establish a stable baseline led to the inability to statistically analyze results. Several of the testing modalities showed no marked improvement, and possible reasons for these responses are presented. This study signifies the need for further research into ORLA as it could be an invaluable resource for individuals with severe aphasia.

## Introduction

Aphasia is an acquired disturbance of language across several modalities caused by brain damage to the regions responsible for language (Cole & Cherney, 2006). A person with aphasia demonstrates impairment in the understanding of and expression of oral language. The degree of impairment is variable, depending on severity of the aphasia. It is also known that damage to the language-dominant hemisphere that results in aphasia tends to disrupt the cognitive processes necessary for reading, and therefore some degree of alexia is reported in the majority of individuals with acute aphasia (Basso et al., 1979; Wertz et al., 1981) and in chronic aphasia, as well (Webb & Love, 1983). That most cases of aphasia are accompanied by alexia demonstrates the true multi-modal nature of the disorder.

Severe aphasia, especially when associated with auditory comprehension problems, has historically been very difficult to remediate, and efficacious treatment options for this type of aphasia are limited (e.g., Sarno et al, 1970). Improved auditory comprehension in such individuals is likely tied to both improved lexical-semantic function and improved stability of the auditory stimulus. Supporting this idea is the fact that many individuals with auditory comprehension deficits perform better during discussion of concrete versus abstract ideas and also benefit from written stimuli to supplement conversational interactions (e.g., Marshall et al., 1973). Important to make note of is the fact that most patients with chronic aphasia have passed the cut-off period for being reimbursed for therapy sessions, so it is of great necessity to come up with a beneficial and efficient way to allow these individuals an innovative way to receive the therapy they need in a cost-effective manner.

Taking all of this information into account, we set out to determine whether or not a computerized reading therapy protocol could augment auditory comprehension in severe aphasia. We explored whether the idea of supplementing auditory comprehension with written stimuli might be turned on its head so to speak, such that the treatment of reading comprehension could be utilized to strengthen auditory comprehension skills in an individual with severe aphasia and alexia. We used computerized Oral Language for Reading in Aphasia (ORLA; Cherney, 2010), which involves the repeated reading aloud of sentences first with a clinician followed by independently. Early studies of ORLA presented positive results, showing that individuals improved in areas of reading comprehension and other modalities such as auditory

comprehension and written expression (Cherney et al., 1986, 1995). The nature of ORLA is that it has a focus on connected discourse instead of reading aloud single words, and this allows the participant to experience and produce natural rhythm and intonation (Cole & Cherney, 2006). We hypothesized that treating reading comprehension would also strengthen lexical-semantic ties and lead to improved auditory comprehension and functional reading. Our specific research questions were as follows:

1. What is the feasibility of the ORLA protocol for severe aphasia?
2. Can training of written language comprehension augment spoken language comprehension?
3. What are the ways to measure progress in comprehending written and auditory stimuli for those with severe aphasia?

## **METHODS**

### **Subject Description**

The research participant, who will be referred to as Jxx for the remainder of this paper, is a 58-year old male. Jxx is approximately thirty months post a large left-hemisphere CVA secondary to left internal carotid dissection. Prior to his CVA, Jxx was employed as the vice-president of a large transportation company, a position from which he has since retired. Jxx was initially diagnosed with severe, global aphasia. He received intensive inpatient and outpatient speech therapy for approximately twelve months following medical stabilization and made small gains in both receptive and expressive language during this time, such that his aphasia evolved from global to severe Broca's, with continued severe expressive and moderate to severe receptive language deficits.

### **Procedures**

#### *Experimental Design*

Utilizing a single-subject, ABA design, we evaluated the effects of a computerized reading therapy protocol program. Following cessation of traditional speech-language therapy, Jxx has participated in several treatment research studies designed to facilitate his expressive language skills. Most recently, he completed a course of intensive MIT (Melodic Intonation

Therapy), but with equivocal results. It was hypothesized that that Jxx's inability to gain more benefit from MIT was due to his continued auditory comprehension deficits. Therefore, the current study was designed to focus on Jxx's decoding and reading comprehension skills with the idea that improving these skills would translate to improved auditory comprehension via improved access to lexical-semantic representations.

### *Pre-treatment Evaluation*

Prior to treatment initiation, Jxx was given a battery of tests. The Boston Naming Test, which is a 60-item test evaluating a participant's word retrieval ability, was presented. During administration of the BNT, the participant is shown a picture and then asked to name the item shown. The Boston Diagnostic Aphasia Evaluation was given to Jxx in order to look at several aspects of his expressive and receptive language abilities. We used the picture describing section to see how much of his expressive language he could access in describing a picture in which many things are happening. We used the auditory comprehension section to determine how much information he was able to understand and process. The reading section gave us a range of his abilities in that modality.

We also administered ten probes in both the auditory and written modalities. The auditory probes were given verbally by us, and following our reading the prompt Jxx was to perform the specific action (e.g. touch your head). The written probes were short commands, and Jxx was to perform the specified action after reading the probe. However, Jxx was never able to perform any of the written prompts upon request.

The PALPA (Psycholinguistic Assessments of Language Processing in Aphasia: Lesser & Coltheart, 1992) was used as well, and we chose four different subtests, as follows:

- Section 47: Uses spoken word-picture matching to assess semantic comprehension
- Section 48: Uses written word-picture matching to assess semantic comprehension ability
- Section 55: Uses spoken sentence-picture matching to assess comprehension of heard sentences

- Section 56: Uses written sentence-picture matching to assess comprehension of sentences after reading them

Please refer to Table 2 to review results of pre- and post- treatment PALPA scores.

### *Treatment Probes and Outcome Measures*

In order to determine whether or not ORLA was improving comprehension, we administered weekly probes that prompted Jxx to perform an action. This was done both verbally, with him performing the action after it was read aloud to him, as well as after reading the prompt himself. These probes were similar to those administered to Jxx during pre-treatment testing, however we ensured the most accurate results by making sure each sentence consisted of a different noun and verb combination, and in this sense we avoided over-testing the same stimulus.

Each week we also administered the PALPA to Jxx. We utilized the same sections within the test as we did pre-treatment, however again made sure to use different targets across each section. We tested Jxx each week with ten questions from each of the four target subtests of the PALPA, equaling forty questions per week. In addition, we also observed while Jxx used the ORLA program each week. A detailed description of the ORLA program can be found in the treatment section of this paper. On average he would perform three or four sentences for us each session. This helped us to gauge his progress within the program and allowed us to be sure he was on the correct grade level within ORLA.

### *Treatment Description*

The treatment program consisted of repeated usage of the computerized reading therapy program ORLA (Cherney, 2010). In some cases, the therapist will administer ORLA to the client and perform each sentence with him or her. However, in our design, we had Jxx practice ORLA at home and completely independently. Aside from a weekly check to make sure the software was working properly and that he was on the right level within the program, Jxx was using the software on his own.

ORLA is based in part on an errorless learning paradigm in that the client reads aloud in tandem with the voice on the computer and while individual words are highlighted. ORLA

incorporates rhythm, pacing, and linguistic templates, and it is these three important elements that make it an efficacious treatment option for those with aphasia as it helps them establish an underlying oscillatory rhythm, melody, and rate for speech production (Square et al., 2001). ORLA's focus on connected discourse allows the individual the opportunity to practice a variety of grammatical structures. Four levels of difficulty are included within ORLA and they are based upon length of utterance and reading level. Level 1 consists of simple 3-5 word sentences at a first-grade reading level; level 2 consists of 8-12 words at a third-grade reading level; level 3 consists of 15-20 words that comprise two or three sentences presented at a sixth-grade reading level; and level four consists of 50-100 words comprising a simple paragraph also presented at a sixth-grade reading level (Cherney, 2010).

The first step in ORLA includes having the participant hear a sentence presented out loud. After hearing the sentence, the participant then points to each word in the sentence as it is highlighted in red on the screen. The participant then repeats the sentence out loud along with the computer voice. After repeating the sentence again, the participant is prompted to point to a verbally presented word. The program then circles one of the words in the sentence and asks the participant say the circled word. After answering these questions, the participant repeats the sentence one more time. After following each of these steps, the individual may move on to the next sentence. A step-by-step description of ORLA can be seen by referring to Appendix A.

Jxx and his wife were given a log on which to record Jxx's use of the treatment protocol. On average, Jxx used the program three times a day for thirty minutes each session. At the beginning of treatment Jxx was completing ORLA's level one, which consists of simple three to five word sentences presented at a first-grade reading level. During week three, he moved up to level two, consisting of eight to twelve words that are either single sentences or two shorter sentences, and these are given at a third-grade reading level.

## **RESULTS**

### **Pre-treatment versus post-treatment results**

Results from our written and verbal control probes can be seen by referring to Table 1. The written stimuli never improved, that is to say that Jxx was never able to complete the action after reading the prompt. During pre-treatment testing, he was able to read the last word (the

noun of the prompt) for eight out of the ten prompts. During post-treatment testing, he was able to read the last word in all ten prompts and was identifying the article “the”. On the other hand, in our verbally presented stimuli Jxx improved from 60% accuracy in pre-treatment testing to 90% in post-treatment testing.

Table 2 presents the data from pre- and post- treatment PALPA testing. Testing from subtests 55 and 56 showed no substantial improvement, in fact showing a decline in his performance in subtest 56. Subtest 47 was at ceiling during both pre- and post- treatment measures. Subtest 48, however, showed marked improvement from 60% in pre-treatment testing to 100% accuracy in post-treatment testing.

Jxx’s performance on the Boston Naming Test changed very little from pre- to post-treatment. During pre-treatment testing Jxx scored fifteen out of sixty on the BNT. Post-treatment testing put him at sixteen out of sixty correct. We also gave Jxx parts of the Boston Diagnostic Aphasia Evaluation. The areas of the BDAE that we utilized in testing include the picture description, auditory comprehension (including word comprehension, ability to follow commands, and understanding of complex ideas), and reading (picture-word matching, word matching with homophones, lexical decision and oral word reading). Across each of these categories, Jxx showed difficulty in each discipline. Comparison of pre- and post- treatment results of all but one category unfortunately yielded no improvements. The only category that showed marked improvement was the picture describing section, in which Jxx was asked to describe a picture (see Appendix B for the picture and Jxx’s description pre- and post-treatment).

### **Within-treatment results**

Figures 1 and 2 show Jxx’s weekly testing results during treatment for our auditory and written probes as well as the PALPA probes, respectively. Across the written modality, our probes lacked any pertinent information as Jxx was never able to perform the requested action. Had he been able to read the prompt and then perform the action, we can speculate that there might have been an increase in performance each week, and potentially a significant change from pre- to post- treatment. Our verbal probes showed that Jxx improved from 50% during week one to 90% by week five.

The weekly results of the PALPA were mixed. On subtest 47, Jxx started at 80% accuracy during week one, and then jumped up to 100% accuracy each consecutive week. During subtest 48 Jxx moved around from 80% to 100% throughout the treatment period. Subtest 55 is another area. During week one, Jxx was at 60% accuracy. During week two he dropped to 40% correct, and then climbed his way up to an 80% during weeks five and six. Through visual inspection, the time it took him to answer the questions in this category decreased, which brings us to think he was beginning to understand those questions a little more. Subtest 56 shows little improvement, as he gained only 10% throughout the treatment period. Interesting to note is that his accuracy improved across the auditory modalities more than the written ones.

Each week we would also have Jxx perform a few sentences for us via ORLA. Each week he performed better than the last and was visibly more confident in his abilities. We made note of the fact that he began to choose the right word when prompted, and his fluency level was rising each week. Jxx was very motivated to use the program and enjoyed using it. His wife consistently expressed how well she felt he was doing, and she could see an improvement in his expressive language abilities almost immediately. She mentioned that he would get up and practice the program at his own will several times a day, and that she was beginning to notice more confidence in him. We see these improvements in Jxx as a sign of his progression through treatment.

## **DISCUSSION**

Through this study, we aimed to determine if a computerized reading therapy protocol could augment auditory comprehension. We used Oral Language for Reading in Aphasia (ORLA: Cherney, 2010), which if found to be effective could be a tremendous resource for Speech-Language Pathologists in treating their clients with aphasia. There is vast evidence supporting the idea that language comprehension is a complex task that requires multiple areas of the brain to function together (Nakada et al., 2001), and that is most likely an attributing factor as to why severe aphasia is generally a tough disorder to remediate. As severity of aphasia and therefore deficits in language domains vary across each and every individual, it is not expected that each participant will improve on every measure assessing auditory comprehension and oral expression (Cherney, 2010).

Due to time constraints, we were unable to establish a stable baseline performance on study probes and therefore we were unable to statistically analyze the data. Instead, we chose to examine the results in a qualitative manner. Visual inspection of our probes clearly showed that Jxx did not improve in each area that we tested. His performance on written and spoken sentence comprehension (subtests 55 and 56 on the PALPA, respectively) for example, showed no dramatic increase from pre- to post- treatment. However, that he was able to correctly identify each written word-picture task (PALPA subtest 48) during post-treatment evaluation directly shows that there was an improvement in his semantic comprehension ability. His spike from 60% to 90% accuracy within our verbal probes demonstrated possible gains in auditory comprehension from pre- to post- treatment.

Referring to the Boston Naming Test and the Boston Diagnostic Aphasia Evaluation results, it wouldn't seem that there was any significant progress made in any of the areas in which Jxx was tested. However, when looking at the picture description task within the BDAE, it is evident that he did progress in that modality as he was able to provide more word descriptions than he was prior to treatment. He went from telling us three words about the picture to eight words, and that symbolizes positive growth in his expressive language abilities. At the end of treatment, Jxx expressed sincere interest in continuing his use of ORLA despite our study being finished. Taking a look at Figure 2, we find slight improvement over time throughout each category, and that in and of itself warrants his further continuation of ORLA.

Figure 1 reveals the written probe results in a somewhat puzzling manner. The fact that Jxx was never able to complete one task across this entire treatment period (including both pre- and post- treatment probes as well as weekly probes) most likely signifies that he never understood that he was to read the prompt and then perform the action. Coming to that conclusion is a result mainly of his near perfect performance across the verbal modality of the same type of prompt combined with his gains in reading skill. Repeated explanations of the directions within this task were unsuccessfully transmitted to Jxx, and it appeared that he was unaware of this problem. That being said, we feel that if he had been able to understand the directions in this section of testing, his results may have presented differently.

**What is the feasibility of the ORLA protocol for severe aphasia?**

Our first research question is in our opinion a simple answer! Yes, ORLA is indeed feasible for use with individuals with severe aphasia. In this case, it was apparent that ORLA was benefitting Jxx. Not only did his scores improve on a few different tested items, but his confidence grew tremendously over the course of the treatment protocol. Upon first meeting Jxx, he rarely used anything more than one word answers. By the end of treatment, he was spontaneously stringing together three to four words at a time in response to questions. Aside from his personal reactions, his wife had nothing but positive remarks about ORLA. She was amazed at his progress and she noticed a definite improvement in his expressive language abilities. Toward the end of this treatment protocol, Jxx traveled with his family on a cruise, which is something they thought he would never be able to do, and per his wife independently used his language skills to communicate successfully with other people. It is of our opinion that given continued use of ORLA, Jxx would continue to improve in each area of language.

### **Can training of written language comprehension augment spoken language comprehension?**

Based on the results of our verbal probes we would say that written language comprehension can augment spoken language comprehension. Through ORLA, our subject was being pushed to improve his written language comprehension. He practiced the program every day, and in the end his hard work paid off. Looking at his 30% improvement in our verbal probes during post-treatment measures, it is clear that his auditory comprehension improved. Although his performance on the PALPA auditory stimuli showed no change, we would argue that the complexity of that information may have been on a level beyond his comprehension abilities at this point in time. His variable performance on both subtests of the PALPA that test sentence comprehension is an indication of his inability to truly process the information.

### **What are the ways to measure progress in comprehending written and auditory stimuli for those with severe aphasia?**

The methods we used were beneficial in measuring change in comprehension abilities across different modalities. The written and verbal probes that we created had mixed results; it would be worthwhile to keep the verbal probes, however the written probes would need to be edited or there would need to be a definitive way to convey the objective of that section to the

participant. The PALPA was an invaluable diagnostic tool that proved helpful in our analysis of auditory comprehension. However, the mixed results on the sentence comprehension portion of the test were most likely a result of their difficulty and the degree of aphasia severity must be considered prior to using those probes. The BNT and the BDAE are tools that should always be used in testing the areas of spoken and written comprehension. While Jxx didn't statistically improve within these tests, we believe that with further ORLA exposure his measures in those tests would likely improve.

## **Conclusion**

We were unable to see quantitative gains during this study, however we believe that with more time using the program Jxx will be able to make strides in the areas of auditory comprehension and verbal expression. Aphasia is a disorder that drastically impacts a person's daily life. Individuals with aphasia have reported feelings of social isolation, loneliness and loss of autonomy, to name a few (Cole & Cherney, 2006). If a six-week treatment period using ORLA on an independent basis can benefit an individual with severe aphasia at least a slight amount, it is truly worth further testing the program and sharing it with others.

Therapeutic intervention for aphasia is usually given during the acute stage. Despite that fact, it takes a great deal of time to regain lost communicative abilities and it typically requires a long-term effort that goes well into the chronic stage of aphasia to remediate (Manheim et al., 2009). Being able to use a computerized program that helps the aphasic individual develop communication skills could be a low-cost solution for clients at the end of the therapy duration allowed by insurance companies. There is such a demand for a program like this that further exploration of ORLA should be seriously considered.

ORLA was developed to improve reading comprehension in persons with aphasia by providing practice in both the semantic and phonological reading routes (Cherney, 2010). As previously mentioned, ORLA has a focus on connected discourse rather than single words, and this allows the modeling of natural intonation and rhythm to the participant. ORLA also follows the principles of learning theory, and this could be another possible explanation for the cross-modal improvement seen in ORLA users (Cherney et al, 2004). ORLA has four levels of treatment that are based on length and reading level, ranging from level one to level four. Having

four levels enables the program to be used by individuals with varying ranges of aphasia severity. Using ORLA as a computer-only treatment lets a patient with aphasia engage in interactive treatment more often and for a longer period of time (Cherney, 2010). Taking all of this information into account, there is no doubt that ORLA is worth further exploring.

This study has shown that even within severe aphasia we can still see great things happening for these individuals. Improving things like auditory comprehension and verbal expression is not out of their reach. Programs like ORLA can open a realm of possibilities to a family dealing with severe aphasia. We know that individuals with aphasia benefit from treatment measures that target linguistic skills, but we also know that the residual communication problems will linger and can have a great impact on the daily lives of these individuals (Manheim et al., 2009). Finding alternative treatment methods to help these individuals is the key to finding new ways to treat severe aphasia, and ORLA is a step in the right direction.

## References

- Basso, A., Capitani, E., & Vignolo, L. (1979). Influence of Rehabilitation on Language Skills in Aphasic Patients: A Controlled Study. *Archives of Neurology*, 36, 190-196.
- Beeson, P.M. & Insalaco, D. (1998). Acquired Alexia: Lessons from Successful Treatment. *Journal of the International Neuropsychological Society*, 4, 621-635.
- Cherney, L., Merbitz, C., & Grip, J. (1986). Efficacy of Oral Reading in Aphasia Treatment Outcome. *Rehabilitation Literature: Special Report*, 47, 112-118.
- Cherney, L.R. (1995). Efficacy of Oral Reading in the Treatment of Two Patients with Chronic Broca's Aphasia. *Topics in Stroke Rehabilitation*, 2(1), 57-67.
- Cherney, L.R., Babbitt, E.M., & Oldani, J. (2004). Cross-Modal Improvements During Choral Reading: Case Studies. Presented at the Clinical Aphasiology Conference, Park City, Utah, May 2004
- Cherney, L. R. (2010). Oral reading for Language in Aphasia (ORLA): Evaluating the Efficacy Of Computer-Delivered Therapy in Chronic Nonfluent Aphasia. *Top Stroke Rehabil*, 17(6), 423-431.
- Cole, R. & Cherney, L. (2006). ORLA (Oral Reading for Language in Aphasia with Virtual Therapist). Presented at 2006 ACRM-ASNR Joint Educational Conference, Boston, Massachusetts, September 27-October 1, 2006.
- Harris, J.L., Rogers, W.A., & Qualls, C.D. (1998). Written Language Comprehension in Younger and Older Adults. *Journal of Speech, Language, and Hearing Research*, 41, 603-617.
- Kendall, D.L., Nadeau, S.E., Conway, T., Fuller, R.H., Riestra, A., & Gonzalez-Rothi, L.J. (2006). Treatability of Different Components of Aphasia- Insights from a Case Study. *Journal of Rehabilitation Research & Development*, 43(3), 323-336.
- Manheim, L. M., Halper, A.S., & Cherney, L.R. (2009). Patient-Reported Changes in Communication after Computer-Based Script Training for Aphasia. *Archives of Physical Medicine and Rehabilitation*, 90(4), 623.

Marshall, J.C. & Newcombe, F. (1973). Patterns of Paralexia: A Psycholinguistic Approach.

*Journal of Psycholinguistic Research*, 2, 175-199.

Mayer, J.F. & Murray, L.M. (2002). Approaches to the Treatment of Alexia in Chronic

Aphasia. *Aphasiology*, 16(7), 727-743.

Nakada, T., Fujii, Y., Yoneoka, Y., & Kwee, I.L. (2001). Planum Temporale: Where Spoken

And Written Language Meet. *European Neurology*, 46, 121-125.

Sarno, T.M., Silverman, M., & Sands, E. (1970). Speech Therapy and Language Recovery in

Severe Aphasia. *Journal of Speech and Hearing Research*, 13, 607-623.

Schuell, H.M., Jenkins, J.J., & Jimenez-Pabon, E. (1964). Aphasia in Adults: Diagnosis,

Prognosis, and Treatment. New York: Harper & Row.

Square, P.A., Martin, R.E., & Bose, A. (2001). The nature and treatment of neuromotor speech

disorders in adults. *Language Intervention Strategies in Adult Aphasia*, 4.

Webb, W.G. & Love, R. J. (1983). Reading Problems in Chronic Aphasia. *Journal of Speech*

*And Hearing Disorders*, 48, 164-171.

Wertz, R.T., Collins, M.J., Weiss, D., Kurtzke, J.F., Frieden, T., Brookshire, R.H., Pierce, J.,

Holtzapple, P., Hubbard, D.J., Porch, B.E., West, J.A., Davis, L., Matovich, V., Mortley,

G.K., & Resurreccion, E. (1981). Veterans Administration Cooperative Study on Aphasia:

A Comparison of Individual and Group Treatment. *Journal of Speech and Hearing Research*,

24, 580-594.

<b>Written Prompts *</b>	<b>Pre-treatment Results</b>	<b>Post-treatment Results</b>
1. Touch your nose	No	No
2. Tap your finger	No	No
3. Point to the computer	No	No
4. Pick up the pencil	No	No
5. Touch your shoulder	No	No
6. Blink your eyes	No	No
7. Move the keys	No	No
8. Wiggle your foot	No	No
9. Pick up the book	No	No
10. Wave your hand	No	No
*Client was unable to perform the action requested by the prompt, however was able to read some of the words (will be discussed in the results section)		
<b>Verbal Prompts</b>		
1. Nod your head yes	Yes	Yes
2. Point at me with your finger	No	No
3. Put the pen on top of the book	No	Yes
4. Touch your head	Yes	Yes
5. Pull on your ear	Yes	Yes
6. Move the cell phone away from the book	No	Yes
7. Clap your hands	Yes	Yes
8. Pick up the keys	Yes	Yes
9. Close the book	No	Yes
10. Shake your head no	Yes	Yes

Table 1: Control prompt pre- and post- treatment results

	<b>Pre-Treatment Results</b>	<b>Post-Treatment Results</b>
<b>Section 47 (auditory stimuli)</b>		
1. Carrot	Yes	Yes
2. Dog	Yes	Yes
3. Hosepipe	Yes	Yes
4. Hat	Yes	Yes
5. Axe	Yes	Yes
<b>Section 48 (written stimuli)</b>		
2. Belt	No	Yes
3. Parachute	No	Yes
4. Syringe	Yes	Yes
5. Lobster	Yes	Yes
7. Moon	Yes	Yes
<b>Section 55 (auditory stimuli)</b>		
1. The horse is kicking the man	No	No
2. The girl is taller than the dog	Yes	No
3. The cat is carried by the horse	No	Yes
8. The girl is buying the cat	Yes	Yes
10. The horse is moved by the man	Yes	Yes
<b>Section 56 (written stimuli)</b>		
23. The horse is hard to kick	No	No
24. This girl has less dogs	No	Yes
25. The man is pulled by the horse	Yes	No
28. The man is following the dog	No	No
29. The cat is easy to bite	Yes	No

Table 2: PALPA control prompt results

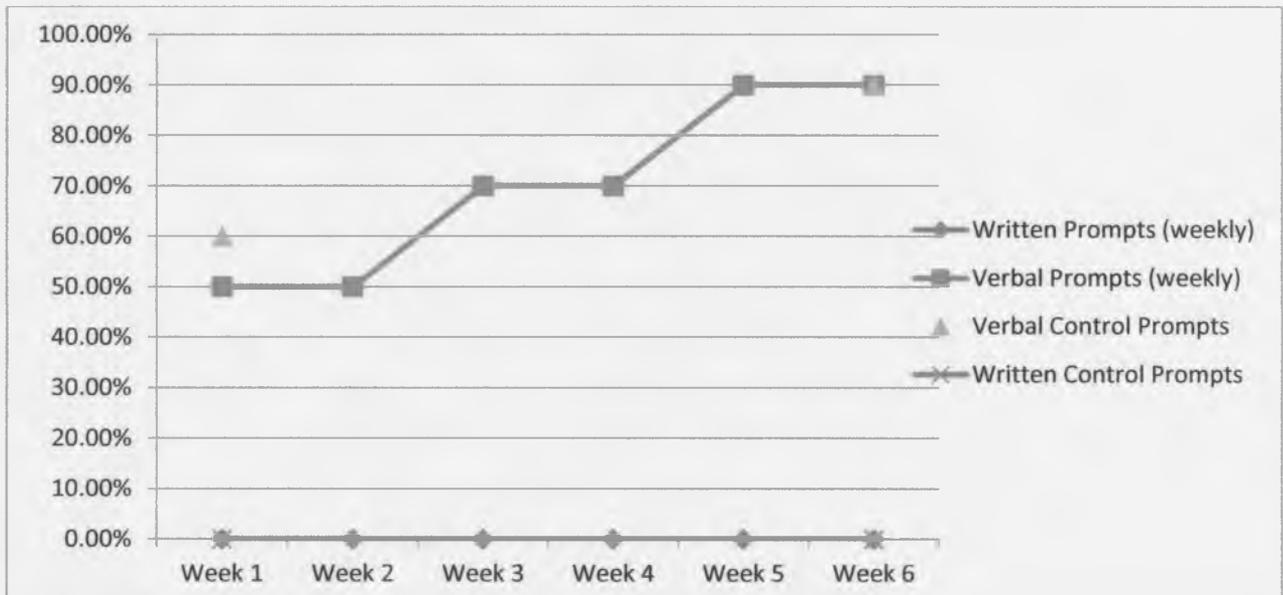


Figure 1: Weekly prompt results and control prompt pre- and post-treatment results for comparison

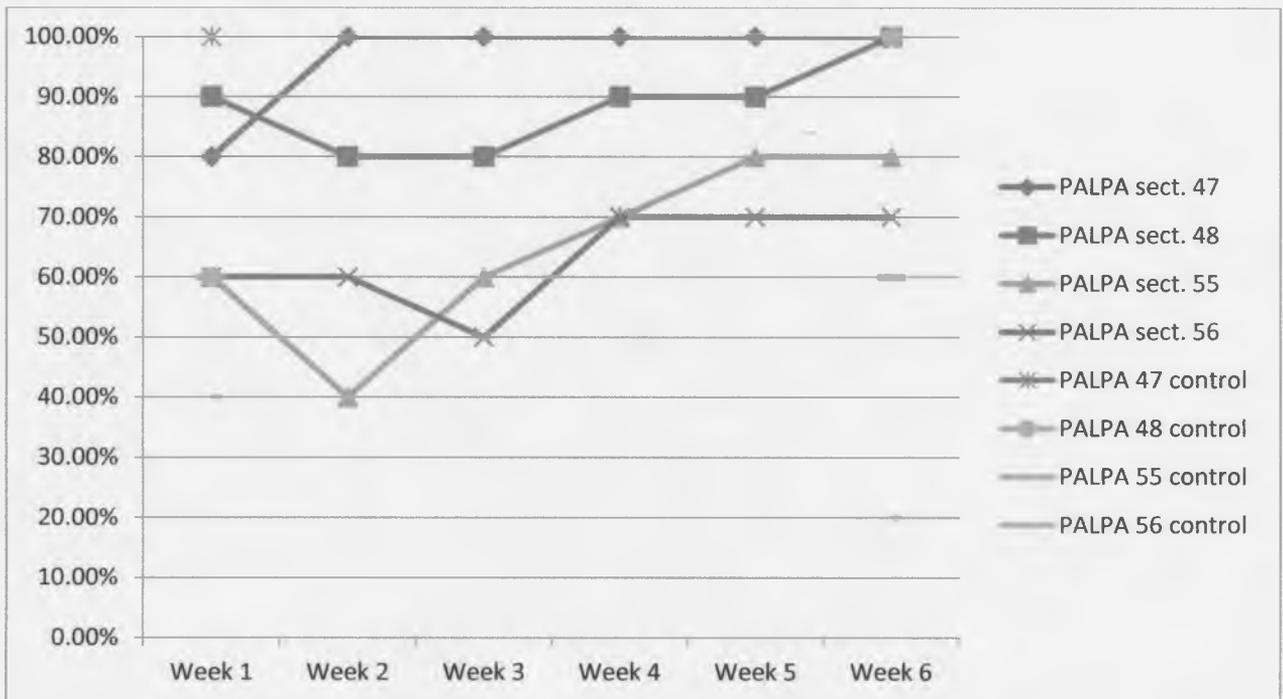
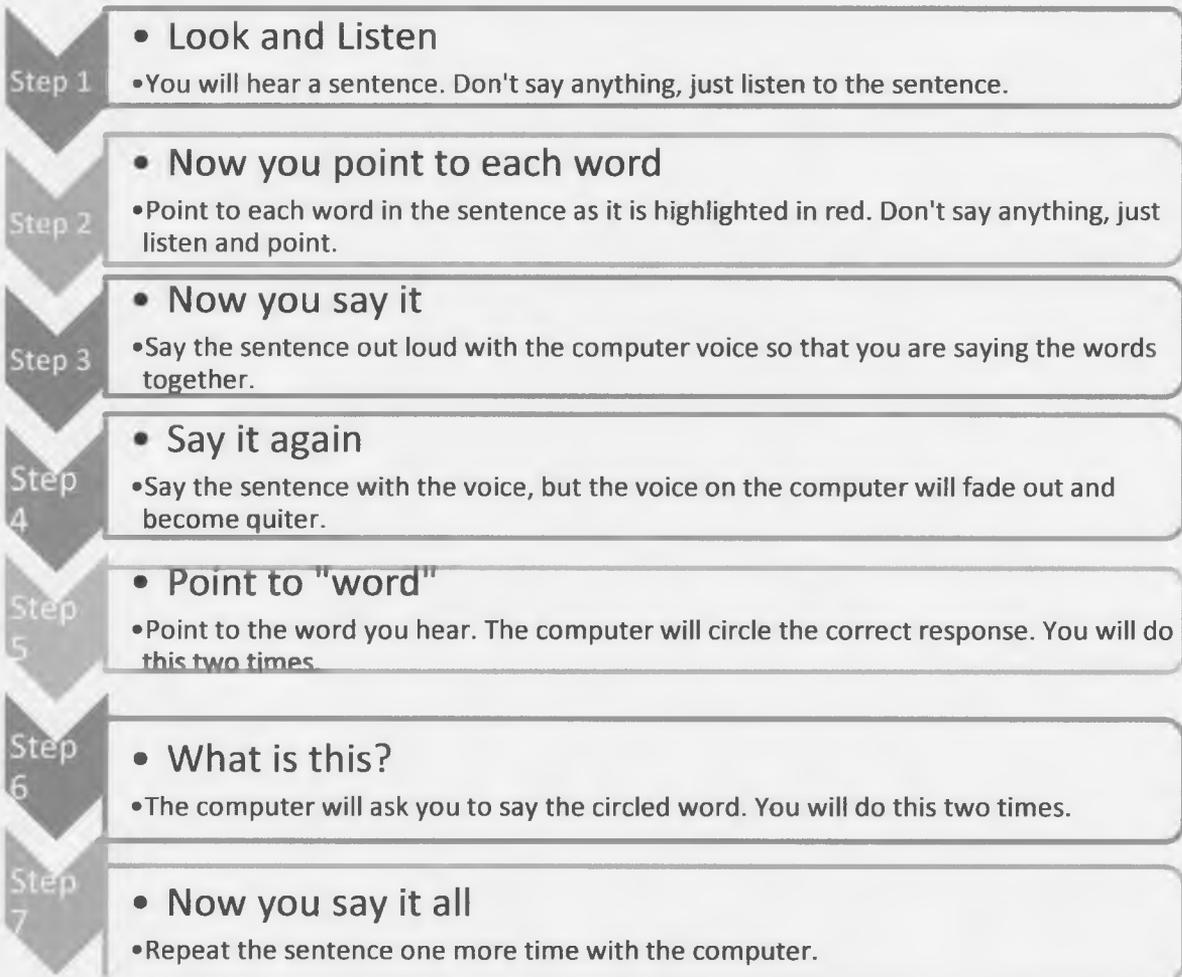


Figure 2: Weekly PALPA results and PALPA control results pre- and post-treatment



Appendix A: Steps presented in ORLA (Cherney, 2010)



“Cookie Theft” picture from the BDAE. (Jxx was asked to describe what he saw happening in the picture.

Pre-treatment responses: Cookies; Homework; No

Post-treatment responses: Cookies; Falling down; She; Sink; Wash; Sink; She was (pointed to kids)