The Effects of Script Therapy in a Patient with Old Chronic Aphasia

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The Effects of Script Therapy in a Patient with Old Chronic Aphasia

Buşra Ensar

Thesis submitted
to the School of Medicine at West Virginia University

in partial fulfillment of the requirements for the degree of

M.S. in
Speech-Language Pathology

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Keywords: chronic aphasia; script therapy; percent script correct; total duration; communication effectiveness; communicative efficiency; single subject; multiple baseline

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ABSTRACT

The Effects of Script Therapy in a Patient with Old Chronic Aphasia

Büşra Ensar

There are some gaps in the literature regarding the efficacy of script therapy in patients with chronic aphasia, particularly chronic aphasia that lasts for several years post-onset, in terms of treatments to improve functional communication during daily activities. This study investigates the relationship between script therapy and communication effectiveness and communicative efficiency. In this context, communication effectiveness was measured by the percent script correct, and communicative efficiency was measured by the total duration to produce the script and the mean duration of pauses at the beginning of sentences.

The efficacy of intensive script training on discourse effectiveness and efficiency was investigated with a patient who had old-chronic nonfluent aphasia (13 years post-onset) using a single subject, multiple baseline design across three different scripts. The participant attended a two-week intensive script therapy and engaged in 15-minute homework activities twice a week.

Our results indicated that the percentage of script-related words used was sensitive to script training intervention, and at the end of this study, the participant demonstrated proficiency with all of the scripts. This allowed him to communicate the sufficient amount of information conveyed in the scripts. Furthermore, script therapy was a part of a global decrease in the duration-related variables, when taking the speed-accuracy trade-off and individual characteristics into account. At the end of this study, the participant demonstrated increased communicative efficiency.

We conclude that intensive script therapy increased communication effectiveness and communicative efficiency for our participant. At the end of the study, he reported using the scripts on a regular basis and expressed an interest in using script therapy in his future speech and language therapies. More research on this relationship, as well as improved experimental control to indicate a certain relation between script therapy and increased functional communication during daily activities, is needed.
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Sincerely,

Büşra Ensar
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I. INTRODUCTION AND LITERATURE REVIEW

Everyday communication, which is essential in completing several daily activities (Davidson et al., 2003), requires discourse - the language beyond a single straightforward clause used for a particular reason (Katz et al., 2000). Some examples of these activities include sharing a personal story, explaining a procedure, or describing an event (Pritchard et al., 2017). Effective discourse requires the consolidation of information units rationally to pass on a meaningful message (Wright, 2011). Research indicates that intensive therapy related to everyday communication increases overall language domains and discourse in individuals with chronic aphasia (Basso & Macis, 2011; Breitenstein et al., 2017; Pulvermüller et al., 2001). However, the effectiveness of script therapy which is a specific type of discourse treatment (Goldberg et al., 2012), in relation to communicative effectiveness in daily communication in people with chronic aphasia spanning several years post onset needs further investigation.

Aphasia, a disorder that affects language production and comprehension (Damasio, 1992), is a common complication of a left-hemispheric stroke (Meinzer et al., 2005). It affects four main regions, each with various degrees of impairment: spoken language expression, spoken language comprehension, written expression, and reading comprehension (ASHA, n.d). Based on spoken language expression, nonfluent aphasia is defined as faltering and effortful speech production (ASHA, n.d). Patients at least six months post-stroke are considered as having chronic aphasia in various studies (e.g., Breitenstein et al., 2017; Allen et al., 2012; Robey, 1998). Individuals with chronic nonfluent aphasia do not make up one homogenous group.

1 We will use the term “old-chronic aphasia” for this specific type of chronic aphasia to differentiate it from more typical definitions of chronic aphasia (i.e., 6 months post-stroke; e.g., Allen, Mehta, Mcclure, & Teasell, 2012; Breitenstein et al., 2017; Robey, 1998).
Instead, the proportion of people who recover can differ depending upon the language treatment the patient received.

**Language Therapy in Chronic Aphasia**

Conventional wisdom in speech-language pathology suggests that chronic aphasia is associated with limited expectation for treatment success beyond one-year post-stroke (Moss & Nicholas, 2006). Although the highest proportion of recovery happens in the early stages after stroke due to the presence of the most active neuroplasticity (Krakauer & Marshall, 2015), several studies provided evidence for recovery for individuals up to 15 years post-onset (e.g., Basso, 1979; Aftonomos et al., 1997; Holland et al., 2017). Specifically, intensive therapy relating to everyday communication has been shown to improve overall language domains and discourse in people with chronic aphasia (Basso, 1979; Breitenstein et al., 2017; Pulvermüller et al., 2001).

Basso & Macis (2011) carried out a study with 23 subjects with chronic aphasia from seven to 64-months post-CVA. Nine had global aphasia, three mixed nonfluent, six Broca, and five severe Wernicke aphasia. While global aphasia and Broca aphasia are considered as nonfluent aphasia types, Wernicke is considered as fluent aphasia (ASHA, n.d). Ten of the clients had been dismissed since no further recovery was foreseen. Intensive treatment was provided once a week with two to three hours of daily homework with the assistance of a family member under the supervision of a speech and language therapist. A heterogenous therapeutic program that focuses on noun naming, action naming, and sentence production was implemented. Maintaining a simple conversation in everyday communication was the common goal regardless of the severity of the aphasia. Significant improvement was observed in averaged Token Test scores and oral and written nouns, sentence production, and action naming. The
authors did not provide effect sizes and could only provide low-level subjective evidence of improvement at the individual subject level. With the given information, it cannot be deduced which type of aphasia is more likely to benefit from the intensive therapy provided. Moreover, this study did not include patients with longer than 64 months post-stroke; thus, it cannot be generalized to all chronic aphasia patients.

Pulvermüller et al. (2001) conducted constraint-induced therapy which is a compact, short-term, and intensive language training (Meinzer et al., 2005) with ten patients (average 8.3 years post-onset) for 30 to 35 hours of mass practice for ten days and conventional therapy with seven patients for the same amount of practice in a more extended period (approximately four weeks). Significant improvement in communicative effectiveness of everyday life was only observed in the group who received constraint-induced therapy. However, this new therapeutic domain requires further investigation to determine the best suitable intensity, carry over, and influence of the aphasia type and other psychiatric deficits on the therapy outcome. The results of this study are somewhat confounded by treatment intensity, such that the results in the patients' communicative effectiveness may be related to the different components of constraint-induced therapy or may be related to the intensity of the treatment. To genuinely compare the two treatment approaches, a more equivalent comparison would have been to provide conventional therapy at the same intensity level. Also, the correlation between the aphasia type and the benefit from constraint-induced therapy needs to be addressed in further studies. Moreover, required minimum or maximum hours of constraint-induced therapy are the most effective for chronic aphasia patients' needs to be investigated.

Breitenstein et al. (2017) carried out a study to evaluate whether three weeks of intensive speech and language therapy (at least ten hours per week) effectively increases verbal
communication in daily life situations. A large cohort, 156 patients (78 per group), 70 years or younger with chronic aphasia, were randomly assigned to two groups of therapy: three weeks intensive speech and language therapy or three weeks deferral of intensive speech and language therapy as a wait list control group. The Amsterdam-Nijmegen Everyday Language Test A-scale was used at baseline and three weeks following treatment to assess the difference in verbal communication effectiveness in everyday life scenarios. Statistical improvements in verbal communication of patients were only observed following intensive speech and language therapy. Even though this study had a larger sample size than previous studies (Basso & Macis, 2011; Pulvermüller et al., 2001), the results do not apply to people over 70. Also, further studies need to address the minimum treatment hours required for a significant change in communicative effectiveness and the cumulation of treatment effects over repeated intervention periods.

*Script Therapy*

Script therapy is a specific type of discourse treatment in which patients practice personalized, relevant dialogues or monologues (Goldberg et al., 2012). Scripts are typically customized and developed in relevance to the severity of the individual's aphasia. Holland et al., (2010) suggested that participants show enhanced learning in the scripts they created on personally important and exciting topics. Script topics should also be functionally useful in everyday communication. Holland et al., (2010) used the topics of the dialogue scripts, including personal experiences, chats with family members, ordering in a restaurant, phone call, and making arrangements, and the topics of monologue scripts, including introductions, personal stories, prayers, speeches, extracurricular activities, and social plans. It is considered "best practice" to include the person's participation in customizing the script (Holland et al., 2010). Customization of scripts assists patients in achieving automatic speech in real-life discourse
(Youmans et al., 2005). It has also been used to improve functional communication skills in patients with nonfluent aphasia via increased production of words from the target script, grammatical productivity, and speaking rate (Cherney et al., 2008; Youmans et al., 2005). Additionally, patients with nonfluent aphasia were reported to have decreased hesitations, revisions, and repetitions of the target speech units (Goldberg et al., 2012).

Individuals with nonfluent chronic aphasia have varying degrees of inadequacy in conveying the ideas fluently in a flowing speech due to expressive language deficits. Neither linguistic-based approaches nor functional treatments solely target automaticity in speech production for people with aphasia (Youmans et al., 2005). However, script therapy targets automaticity by incorporating repetitive, cue-based, and massive drilling from traditional therapy approaches and personally relevant, natural, conversational, and functional context from functional approaches (Youmans et al., 2005; Goldberg et al., 2012).

During script intervention, a hierarchy is used to acquire fluency in daily speech. Namely, cues are arranged in a hierarchy from least to most helpful, with different types of cues mixed in. An example of this hierarchy is in Youmans et al.’s (2005) study where patients repeated scripts, followed by choral reading with the SLP, and finally attempted to produce it independently. For scripts to become automatic, repetitive practice must frequently occur in a short amount of time (Goldberg et al., 2012). Frequent repetitive practice is emphasized for improvement of automaticity in the script in a short time (Goldberg et al., 2012) because the amount of improvement is found to be directly proportional to the intensity (i.e., more treatment hours per week) of therapy (Lee et al., 2009). In various studies, this competence was achieved in three weeks of intervention per script with extensive practice (Youmans et al., 2005; Cherney et al., 2008; Lee et al., 2009; Goldberg et al., 2012). Mass drilling is required for gaining
automaticity: a total of 30-hour (Bilda, 2011) and 4-4.30 hours intervention, as well as 3.75-7.30 hours of homework (Goldberg et al., 2012), are examples of the duration of the script training. Repetitive drilling occurs with the hierarchy of words, sentences, and conversational turns (Goldberg et al., 2012). By doing so, script therapy targets over--leaning of utterances and automaticity of speech (Goldberg et al., 2012).

Studies investigating script therapy vary widely in their treatment intensity and frequency of application. Bilda (2011) reported that three hours per day for ten days was needed for treatment success, whereas Youmans (2005, 2011) reported 15 or 30 min per day of independent practice, as well as two to three 30- to 60-min sessions per week of clinician-directed treatment. On the other hand, the duration of script training may depend on script mastery (Youmans et al., 2011). Frequent repetitive practice is emphasized for improvement of automaticity in the script in a short time (Goldberg et al., 2012) because the amount of improvement is found to be directly proportional to the intensity (i.e., more treatment hours per week) of therapy (Lee et al., 2009). For example, treatment mastery may take from as few as eight sessions to as many as 19 (Goldberg et al., 2012), or from 1.9 to 16.9 hours per week (Lee et al., 2009). However, the adage "more is better" is not necessarily evidenced by research because the intensity by itself is insufficient without considering the following variables: dose, therapeutic inputs, and client acts (Baker, 2012; Cherney, 2012). Cherney, (2012) stated that regarding the dose, the effect of specific combinations of intensity (form, frequency, duration) needs to be discovered. In terms of therapeutic inputs, we need to define active components in treatments and better understand the function of motor learning and neuroplasticity in supporting learning. Finally, individual qualities, values, and preferences must be considered when determining the best intervention intensity.
There remain gaps in the literature surrounding the effectiveness of script therapy in old chronic aphasia in relation to communicative effectiveness in daily communication. This relation may be under-explored due to the lack of old-chronic aphasia patients' participation in language therapies. Lack of participation may be due to several reasons; however, one main reason may relate to the lack of health insurance coverage in the US for clients with chronic aphasia. This may create a need for a therapy approach that can be implemented promptly and targets functional goals. When combined with functional goals, intensive script treatment, which necessitates frequent, repetitive repetition, may assist in bridging this gap. Therefore, the effectiveness of the scripts that are created to answer the need for an intensive therapy that aids the daily communication of individuals with old-chronic aphasia needs to be further investigated.

Consequently, I was interested in exploring an intensive two-week script therapy program with a patient with old-chronic nonfluent aphasia. I decided to implement three in-person 30-45 minutes sessions per week based on his schedule, motivation, attention span, and previous examples of intensity in literature (e.g., Manheim et al., 2009; Cherney et al., 2014). I also decided to support the treatment process with 15-minute homework two times a week when he did not have therapy.

The following questions are addressed for this study:

1. Would script therapy increase communication effectiveness for a patient with old-chronic nonfluent aphasia? Communication effectiveness was measured using percent script correct (PSC; Youmans et al., 2005).

2. Would script therapy increase communicative efficiency in daily speech? Communicative efficiency was measured in two separate ways: the total duration to produce the script and the mean duration of pauses at the beginning of sentences.
II. METHODS

a. Participant

Participant JW is a 73-year-old monolingual (English-speaking) male. His medical history is unclear, yet he had a cerebrovascular accident in 2008, which resulted in aphasia. He received services for stroke at a Rehabilitation Hospital in Pittsburgh and West Virginia University Speech and Hearing Center. At the time of the study, he was 13 years post-onset of aphasia. He was previously diagnosed with nonfluent aphasia. For the last 12 consecutive years, he has received services at WVU Speech and Hearing Center. In this time frame, his previous goals targeted improving working memory, intelligibility at all levels of production, syntax, and word retrieval skills. Previous treatment approaches included supported communication intervention, semantic feature analysis, and word retrieval cueing strategies.

His current level of functional communication after 12 consecutive years of language therapies was characterized by pauses in the beginning of sentences, filler words, hesitations, slowness, effortful speech, and word-finding difficulties. Contrary to these expressive language deficits, JW's auditory comprehension was indicated to be functional. Therefore, the Western Aphasia Battery-Revised (WAB-R) was conducted to define JW's expressive language deficits further. In particular, Spontaneous Speech, Repetition, and Naming and Word Finding subtests were administered at the beginning of the treatment to identify present expressive language skills and have a valid baseline for this study. Later, the same subtests were conducted at the end of the treatment to compare. According to the most current treatment rationale, current goals were targeted at improving his complex word-finding abilities, syntax, and topic maintenance within the conversational speech.
In addition to the WAB-R, the Aphasia Impact Questionnaire (AIQ-21) was administered pre and post-treatment as a qualitative assessment to determine the participant’s impairment-focused perspective and experience of aphasia. AIQ-21 is a self-report questionnaire that uses a five-point scale (0-good, 4-bad) in three sections: communication, participation, and emotional state/wellbeing. This questionnaire uses a nonverbal system of pointing to pictures to indicate responses. Only the post-questionnaire results were provided in Appendix B. The pre-questionnaire results were unable to be located secondary to misplacement during the department move to the School of Medicine. Based on listening to the recording of the AIQ-21 pre-questionnaire, JW’s language impairment was likely to have a mild impact on activities of daily living. It should be noted that this is based on speculation as we had only the audio commentary to evaluate as the participant’s judgments were based on nonverbal pointing.

b. Research Design

A single subject, multiple baseline design across three different scripts was employed to determine the efficacy of intensive script training on discourse effectiveness and efficiency with a patient who had old-chronic aphasia. Until reaching the stable performance for at least one of the dependent variables, pre-session probes measurements continued to be administered for all scripts to see if the treatment caused a change only in the treated behavior. Multiple baseline design was decided to be the most appropriate design for this study for the following reasons: having one participant so the improvement cannot be reversed immediately and applying the same therapeutic technique (script training) to three independent behaviors (three different scripts) (Heskett, 1986). Treatment effects, if observed, would be replicated in the second and third behaviors to demonstrate experimental control. Additionally, changes in the mean, level,
trend, and variability between the baseline and intervention phases for all scripts were required to establish an experimental control (Goldberg et al., 2012).

Data Collection

The study consisted of four conditions: baseline, treatment, maintenance, and generalization, respectively. In all conditions, the participant completed a pre-session probe in which he was asked to produce the target script without any cueing. Pre-session probes were graphed in results. During the treatment sessions, the participant completed a post-session probe in addition to the pre-session probe. Likewise, the participant was not provided with any cues throughout post-session probe. Post-session probe was solely used as a decision-maker in involving a new script into the intervention phase. The rule was set for 80% accuracy at the primary dependent variable. For instance, when the phone call script had reached 80% correct script-related words, the newspaper script was included in the treatment phase of the experiment. This rule was maintained except for the introduction of the third script, which was delayed due to the JW’s vacation schedule (a two-week break from treatment). Although JW reached over 80% correct script-related words at the end of the first intervention session for the newspaper script (script #2), the introduction of the grocery script was postponed until he displayed an adequate percentage of accuracy one more session after his two-week break. This decision ensured consistency and stability in the post-session probes. During maintenance, the pre-session probes were conducted, and scripts were no longer addressed. The last session of the study was dedicated to the generalization condition. Changes in communication partners, minor alterations in scripts, and transcription of the scripts from the memory were implemented in this condition. Detailed information about all conditions was described in the related separate sections below.
The study was outlined below (Figure 1) to assist clinicians who want to replicate the treatment in future.

**Baseline Condition**
- Pre-session probes on all scripts: 5 min.
- Tasks: Script development, standardized assessments
- No homework reminder

**Treatment Condition**
- Pre-session probes on all scripts (5 min).
- Tasks: Introduced new script(s) and practiced existing scripts
  - Practiced line-by-line
  - 10 repetitions of each using cues as necessary
  - Hierarch of cues: phrase repetition, phonemic cues, independent production
- Post-session probe on treated script determined when to introduce next script
- Homework reminder

**Maintenance Condition**
- Pre-session probe: Identical to baseline
- Task: JW attempts to use the script with the clinician without cues
- Post-test: WAB-R and AIQ-21
- No homework reminder

**Generalization Condition**
- Pre-session probe
- Task: Used scripts with new conversation partner; used scripts with familiar partner who gave unexpected responses, transcribed scripts from memory
- No homework reminder

Figure 1. Study Outline

In this study, scripts remained in the intervention phase until the participant met the script mastery criteria or a maximum of two weeks. In conclusion, the participant had two hours and 45 minutes of intervention for phone call script, one hour and 15 minutes for newspaper script, and
30 minutes for grocery script. Intervention sessions were also held in WVU Speech and Hearing Center (Allen Hall).

**Probe Recordings**

Recordings were made on both a video (Panasonic RQ-I 335) and a voice recorder (Olympus DM-901) device. All data was evaluated by voice recorder (due to quality) with the video recorder used as a backup. Data were transferred to a secure drive and then visualized using Audacity audio software (https://audacityteam.org) (Thompson, 2014).

**Dependent Variables**

Percent script correct was the primary dependent variable in this study. It was calculated by dividing the number of script-related words produced by the total number of words in the script (c.f., Youmans et al., 2005). The script-related words exclusion criterion was defined as any word or phrase substitutions (if not semantic interchangeable), repetitions, filler words and phrases, or circumlocutions since the verbatim practice was underlined during the script training. The number of words was identified per script prior to any analysis.

The total duration of the participant to convey script information was used to measure the increase in communicative efficiency. Total time was calculated by adding the duration of participant's turns throughout the script conversation (Goldberg et al., 2012). This study defined the participant’s turn as the time from the end of the clinician's prompt till the end of the participant's script line. It consisted of the total waiting time at the beginning of sentences and the duration of the participant's produced lines. Throughout the study, total duration was stated in the units of seconds. The mean duration of pauses at the beginning of sentences was the other dependent variable to measure the increase in communicative efficiency. Following the
recording of the participant's script conversation, the duration of pauses at the beginning of sentences was identified and summed up. This amount was also stated in the units of seconds.

**Visual Analysis**

As Goldberg et al. (2012) stated, the results of a multiple baseline study can be described according to either experimental criterion or therapeutic criterion. While therapeutic criterion refers to the clinical significance of the results, experimental criterion refers to how data are determined to display an effect. Commonly, the criteria are ascertained via visually inspecting a graphic display of the data in single-subject case studies. In this study, results will be displayed by four characteristics of the figure: level, trend, stability, and latency (I-Chant A. Chiang; Rajiv S. Jhangiani; and Paul C. Price, n.d.; Lane & Gast, 2014).

According to Lane & Gast (2014), to measure level, visual inspection of the data points solely or mean data point per phase was observed (e.g., low level during baseline, high level during treatment). The trend was measured as the slope of the dependent variable during each phase to reveal the progress over time (I-Chant A. Chiang; Rajiv S. Jhangiani; and Paul C. Price, n.d.). The stability was defined as the variability of the data. The stability envelope used and the percent of data points on or within the stability envelope was calculated. The stability criterion was set for 80% of data points being within ± 25% of the median. The latency measurement was determined by the number of sessions needed for the dependent variable to change. Ordinarily, if a change in the dependent variable occurred soon after a change in conditions, the therapy may instigate the change. This can happen in various ways: the level of the dependent variable can be significantly higher or lower in one condition than in the other, or the dependent variable can begin to rise or fall in response to a change in conditions. These variables are illustrated below in Figure 2.
c. Intervention Procedures

Script Development

The author was the participant’s speech-language pathology student clinician in the semester prior to this study and was therefore aware of communication-related complaints of the patient and the caregiver. This allowed me to develop script topics prior to the first session.

During the first session, the client was empowered to make the final decision on the script topics. Script lengths were determined according to the informal observations during the unscripted conversations in the first session and the therapist's clinical judgment of previously carried out sessions with the client.
The script development session was held in WVU Speech and Hearing Center (Allen Hall). The first session of the study timeframe began with a general conversation about his ongoing treatment and daily life. Then, the clinician offered action-verb pictures of the previously developed possible script topics (grocery shopping, self-introduction, and phone call) and role-played a sample script to visualize the process. Each topic was discussed in depth. Next, the participant was asked for any other opinions and to determine three final script topics, including any offered possible script topics. Subsequently, he was offered three subordinate topics per the main topic and asked to select one subordinate topic per the main topic. To illustrate, when the participant selected the topic of 'phone call', he was offered these three subordinate topics: making an appointment over the phone, phone call to a pharmacy regarding a prescription, and emergency phone call. Throughout the session, the clinician noted any information that the client wished to include in the scripts. In conclusion, three scripts were drafted and read to the client for final approval. He was reminded to have the right to make any modifications.

Final scripts included grocery shopping, a phone call to the pharmacy regarding prescription, and a morning conversation with his wife over the newspaper. They consist of 22, 27, and 22 words, respectively. Final scripts are presented in Appendix A.

Baseline

Pre-session data was collected in the first five minutes of each session. The participant was asked to either produce the scripts or have a short conversation about script topics independently beginning from the first session (Youmans et al., 2005). Each conversation was planned to last about one to two minutes. While the therapist corresponded loosely with the ongoing short conversation, no feedback or cues were given (Goldberg et al., 2012). All
conversations were recorded and analyzed for the following dependent variables: percent script correct (PSC), the total duration to produce the script, and the mean duration of pauses at the beginning of sentences (described in detail below). No visible upward trend in pre-session probes for at least three sessions was required to initiate the first script.

Treatment

Script therapy began with repeated practice of the script, which can be done in several modes, such as listening, repeating, reading aloud, producing from memory, or a combination of these (Cherney et al., 2014; Goldberg et al., 2012). Previous studies (Goldberg et al., 2012; Youmans et al., 2005) were used to create script training procedures for this study. Scripts were planned to be trained one line at a time. The following cueing hierarchy was applied when needed: phrase repetition, choral reading, and independent production. The cues were ranked in order of least to most helpful. A choral reading cue was given to the participant after he failed to produce the script line independently. The target line was read aloud by both the physician and the participant at the same time. If he couldn't achieve in this degree of cueing, he supplied phrase repetition. Two criteria were created for adding a new line in training; either the participant performed the previous line at least ten consecutive times at the given cueing level or preferred moving to the following line after practicing five times to prevent frustration. After the fifth time of practicing the same line, the clinician judged either asking the participant to move to the following line or continue practicing. This judgment was made according to the complexity of the line, confidence of the participant, being a 'more-struggled' line, and being a 'time-consuming' line. Still, the participant had the final decision of skipping or staying in the same line. Upon his request, the participant was allowed to practice any word or phrase at any time during the intervention sessions.
Homework was conducted in any place that the participant wished for a maximum of 15 minutes. The participant was given homework two times a week on the days he did not have intervention sessions. He listened to a digital recording of the scripts at the beginning of each homework session. Scripts were recorded in two ways directly onto the participant's phone to increase convenience. The first was a full recording of the scripts, typically read by two speakers (the clinician or an undergraduate student of Speech Motor Control Lab). If there was no student present, the clinician read and recorded both the participant’s and other lines. The second recording was a reading of the scripts where the participant’s lines of the script were not spoken, but a pause was included to allow him to say the line to practice.

To continue, he was asked to read the script out loud and practice the script from the beginning to include the lines learned in the previous session. He was also asked to practice according to the current level of cueing. In order to encourage his participation in homework, the participant was reminded of his homework on the days he did not have in-person sessions.

The study allowed the implementation of the following methods if any problem arose during treatment sessions. To illustrate, JW came up with semantically interchangeable words or phrases during the data collection. He said, “Can you help me find somebody who can?” instead of “Can you find me someone else who can help?”. It was also noted that he used the phrases "I need" and "I want" and the words 'this' and 'it' interchangeably. In similar circumstances, decisions were made based on the presence of a synonym of a word, if the new sentence/phrase was syntactically appropriate, functionally equivalent, and the clinician's judgment. In addition, a modification was made to the cueing hierarchy following the implementation of WAB-R. As it was decided earlier, when necessary, the following cueing hierarchy would have been used: phrase repetition, choral reading, and independent production. However, as previously
mentioned, JW appeared to benefit from phonemic cues during the Word Fluency subtest of WAB-R. Thus, choral reading was replaced with phonemic cues in the cueing hierarchy. In general, the updated cueing hierarchy was found to be feasible and beneficial.

Maintenance and Generalization

The maintenance phase lasted two sessions for all scripts and did not include any implementation of script treatment or direct instruction on completing homework assignments. The last session was dedicated to generalization probes. Three generalization probes were implemented for all scripts: a script conversation with a novel communication partner, a more challenging script conversation with the clinician, and writing the scripts from memory. At the first probe, the novel communication partner (an undergraduate student) had limited information about the script and the ongoing study. This individual was only informed about the topic of the script and his duty in this task. At the second probe, the clinician gave varying responses and comments or said appropriate but interesting things during the script conversation to make it challenging. At the last probe, the participant was asked to transcribe the script from his memory without cues.

III. RESULTS

In this section, the study results were displayed under three dependent variables. Associated graphs were presented separately for each dependent variable. While dependent variables were presented in the y-axis, sessions were presented in the x-axis. Vertical lines were drawn through the point time when a transition to a new phase of the study occurred. All four phases of the study were demonstrated in each graph, and scores were presented per session for three scripts. By doing so, the reader was enabled to compare the data per phase across all scripts. Mean and median values were also displayed in tables per phase for three scripts under
related dependent variables. These values enabled the reader, as well as the author, to determine level and stability, respectively.

**PERCENT SCRIPT CORRECT**

The line graph below (Figure 3) compares the percentage of script-related correct words (y-axis) between three different scripts throughout the 12-session study period (x-axis). Overall, the percentage of script-related words used was sensitive to script training intervention, as evidenced by the visual inspection of the data.

**Phone Call Script**

During the baseline phase, percent script-related words remained stable (100%) with a marginal change in the performance. A low level was observed in this phase with a mean of 27.3% (Table 1). No discernible trend in the performance was noted during this phase.

During the treatment phase, a substantial climb in performance from 22% to 85% was observed in a period of first five treatment sessions. Subsequently, a decline to 65% was noted at the last treatment session. There appeared to be a clear upward trend in PSC during this phase and considering the median values (Table 2), the data was stable (83%). Additionally, a high level was observed with a mean of 56.3% (Table 1). Comparing the levels across baseline and treatment phases, the phone call script demonstrated an improving level. As for latency, change in the PSC with the intervention was observed in the second treatment session.

During the maintenance phase, significant growth in the performance was present, and using script-related words hit a high of 96%. An upward trend was noted for the phone call script and the data was stable (100%). A high level was observed within the phase and there was an improving level compared to the treatment phase.
Last but not least, at the generalization session, the PSC for the phone call script was 88%. Comparing the mean PSC between the maintenance and generalization phases, the participant demonstrated an improving level during the generalization session.

Newspaper Script

In the baseline phase, the newspaper script demonstrated a low level with a mean of 1.6% (Table 1). The participant’s performance remained steady at the level of 0% throughout this phase with a minor increase to 8% in the third session. There was not a visible trend, and the data was stable (80%) in this phase.

In the treatment phase, there was a substantial change in the performance from 0% to 95% in a period of four sessions. An upward trend was observed as well as an improving level with a mean of 68.2% (Table 1). The PSC appeared to have a definite upward trend, and the data was variable (75%). In terms of latency, the intervention caused a change in the PSC in the second treatment session.

In the first maintenance phase, the use of percent script-related words leaped and reached a peak of 100% for the newspaper script. It was followed by a fall in performance to the level of 63%. There was a downward trend in this phase, however, an improving level was noted compared to the mean PSC during the treatment phase. On the other hand, considering the median value (Table 2), the data was stable (100%).

In the generalization phase, the participant attained a high level of 100% by using all script-related words. When the mean PSC was compared between the maintenance and generalization phases, the participant's performance level was also noted to be improved during the generalization session.
Grocery Shopping Script

During the baseline phase, the percentage of script-related words fluctuated after the first three sessions, with an upward trend in performance. The grocery shopping script demonstrated a low level, and the data was variable (71.4%).

In the treatment phase, the PSC of the grocery shopping script displayed an improving level, as well as an upward trend. Additionally, the change in the PSC with the intervention was observed in the second treatment session. The data, on the other hand, was shown to be variable (0%) when looking at the median value (Table 2).

During the first maintenance session, the participant’s performance of using percent script-related words peaked at 100%, followed by a fall to 63%. Thus, the grocery shopping script displayed a downward trend in this phase. Even so, when the mean values (Table 1) were taken into account, a high level was discovered. Last but not least, the data was stable (100%).

During the generalization session, the grocery shopping script demonstrated an improving level compared to the treatment phase.
### Table 1. Mean percent script correct per phase per script

<table>
<thead>
<tr>
<th>Scripts</th>
<th>Baseline</th>
<th>Treatment</th>
<th>Maintenance</th>
<th>Generalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone Call</td>
<td>27.3</td>
<td>56.3</td>
<td>84</td>
<td>88</td>
</tr>
<tr>
<td>Newspaper</td>
<td>1.6</td>
<td>68.2</td>
<td>81.5</td>
<td>100</td>
</tr>
<tr>
<td>Grocery Shopping</td>
<td>10.2</td>
<td>24</td>
<td>81.5</td>
<td>90</td>
</tr>
</tbody>
</table>

### Table 2. Median values of percent script correct per phase per script

<table>
<thead>
<tr>
<th>Scripts</th>
<th>Baseline</th>
<th>Treatment</th>
<th>Maintenance</th>
<th>Generalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone Call</td>
<td>26</td>
<td>62</td>
<td>84</td>
<td>N/A</td>
</tr>
<tr>
<td>Newspaper</td>
<td>0</td>
<td>39</td>
<td>81.5</td>
<td>N/A</td>
</tr>
<tr>
<td>Grocery Shopping</td>
<td>9</td>
<td>24</td>
<td>81.5</td>
<td>N/A</td>
</tr>
</tbody>
</table>
Figure 3. Percent script correct per phase per script
**TOTAL DURATION TO PRODUCE THE SCRIPT**

The line graph below (Figure 4) provides information about the total duration (in seconds) to produce the script (y-axis) across three different scripts in the 12-session study period (x-axis). To conclude, the effect of script therapy on the total duration to produce the script was apparent upon visual inspection of the figures.

*Phone Call Script*

Firstly, fluctuations were noted in the total duration of script production for the phone call script during the baseline phase. It was remarked with a low level and an accelerating trend. Moreover, taking the median values (Table 4) into account, the pre-session probes data was stable (100%).

Secondly, the participant’s performance kept fluctuating in the treatment phase as well. Notwithstanding, the total duration to produce the phone call script plummeted steeply at session eight. Considering the mean values (Table 3), a high level was present. On the contrary to the baseline phase, a downward trend in performance was indicated in the phone call script. Regarding the latency, a decrease in the total duration of producing the script was observed at the fifth session of intervention for the phone call script. Furthermore, the data was variable (33%).

Thirdly, the total duration demonstrated a deteriorating level for the phone call script throughout the maintenance phase. Additionally, a decelerating trend came into view. Also, the data was variable (0%) in this phase.

Finally, at the generalization session, the participant produced the phone call script in 27.8 seconds. In this phase, the phone call script showed up a deteriorating level compared to the maintenance phase.
Newspaper Script

The baseline period was characterized by fluctuating performance of the total duration to produce the newspaper script. The participant demonstrated a low level and a downward trend in performance throughout this phase. In addition, the participant's performance over the course of the overall time it took to produce the newspaper script was variable (40%).

In the treatment phase, the numbers for the newspaper scripts fluctuated. Furthermore, the total time it took to produce the newspaper script dropped dramatically during session nine. An improving level compared to the baseline phase was noted and a decrease in the total duration of producing script was observed in the fourth session of intervention. In addition, JW’s performance demonstrated a downward trend in this phase. Considering the median values (Table 4), the data was indicated as variable (75%) in this phase.

Throughout the maintenance phase, the total duration demonstrated a deteriorating level (Table 3) compared to the treatment phase for the newspaper script. In both maintenance sessions, the participant completed the script in 34 seconds. Thus, the data was stable (100%), and no trend was observed in this phase.

Lastly, at the generalization session, the newspaper script showed up a low level.

Grocery Shopping Script

A gradual decrease in the total duration to produce the grocery shopping script was observed throughout the baseline period except for the last session where a rise of 17 seconds was noted. According to Table 3, a high level was also indicated in this phase, as well as a downward trend. The participant’s performance was variable (57%) in the baseline phase for the grocery shopping script.
A marked increase of 15.9 seconds in total duration was noted for the grocery script during the treatment phase. In this phase, a deteriorating level in the performance was present compared to the baseline phase. Moreover, an upward trend was indicated in the grocery shopping script. A decrease of 20.6-second in total time occurred at the first treatment session and considering the median values (Table 4) the participant’s performance in this phase was stable (100%).

The total duration to produce the grocery script demonstrated a deteriorating level during the maintenance phase. In addition, an accelerating trend appeared for the grocery script and the data was stable (100%).

Last but not least, the participant produced the grocery shopping script in 18.8 seconds during the generalization session, which also indicated a deteriorating level compared to the maintenance phase.
<table>
<thead>
<tr>
<th>Scripts</th>
<th>Baseline</th>
<th>Treatment</th>
<th>Maintenance</th>
<th>Generalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone Call</td>
<td>45.8</td>
<td>61.3</td>
<td>42.3</td>
<td>27.8</td>
</tr>
<tr>
<td>Newspaper</td>
<td>46.5</td>
<td>52.3</td>
<td>34.2</td>
<td>25.2</td>
</tr>
<tr>
<td>Grocery Shopping</td>
<td>44.9</td>
<td>34.7</td>
<td>30.9</td>
<td>18.8</td>
</tr>
</tbody>
</table>

Table 3. Mean total duration to produce the script per phase per script

<table>
<thead>
<tr>
<th>Scripts</th>
<th>Baseline</th>
<th>Treatment</th>
<th>Maintenance</th>
<th>Generalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone Call</td>
<td>47.2</td>
<td>66</td>
<td>42.3</td>
<td>N/A</td>
</tr>
<tr>
<td>Newspaper</td>
<td>45.8</td>
<td>60.9</td>
<td>34.2</td>
<td>N/A</td>
</tr>
<tr>
<td>Grocery Shopping</td>
<td>41.2</td>
<td>34.7</td>
<td>30.9</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Table 4. Median values of total duration to produce the script per phase per script
Figure 4. Total duration (seconds) per phase per script
MEAN DURATION OF PAUSES AT THE BEGINNING OF SENTENCES

The line graph below (Figure 5) shows the mean duration (in seconds) of pauses at the beginning of sentences (y-axis) across three different scripts in the 12-session study period (x-axis). In a nutshell, on visual inspection of the figures, the effect of script therapy on the mean duration of pauses at the beginning of sentences was noticeable.

Phone Call Script

During the baseline phase, the mean duration of pauses at the beginning of the sentences varied considerably for the phone call script. The phone call script demonstrated a low level, a downward trend, and variable (33%) data.

In the treatment phase, the mean duration of pauses at the beginning of the sentences fluctuated with a downward trend for the phone call script. The participant’s performance reached a peak of 13.9 seconds at the fourth session of treatment, and interestingly enough, had plunged and reached a low of 0.2 seconds by the following treatment session. Considering the mean values (Table 5), the phone call script displayed a high level. The data was also variable (33%) when the median values (Table 6) were taken into account. Regarding the latency, the decrease in the mean duration of pauses at the beginning of sentences occurred in the fifth treatment session for the phone call script.

Throughout the maintenance phase, the participant’s performance declined substantially for the phone call script and reached a low of 0.4 seconds. The mean duration of pauses at the beginning of sentences demonstrated a deteriorating level compared to the treatment phase. The participant’s performance at this phase was variable (0%), and a decelerating trend in the performance was also noted.
During the generalization session, the participant’s mean duration of pauses at the beginning of sentences was 2.6 seconds as illustrated by a deteriorating level compared to the maintenance phase.

**Newspaper Script**

During the baseline phase, the mean duration of pauses at the beginning of the sentences was characterized by a low level, decreasing trend, and being variable (60%).

During the treatment phase, the participant’s performance ranged from 15.7 seconds to 1.2 seconds, with the newspaper script showing a downward trend. Taking the median values into account (Table 6), his performance was noted to be highly variable (0%). Considering the mean values (Table 5), the newspaper script displayed an improving level. Regarding the latency, the decrease in the mean duration of pauses at the beginning of sentences took place in the second treatment session for the newspaper script.

Throughout the maintenance phase, the participant’s performance sustained a low level for the newspaper script and was characterized by a decelerating trend and stability (100%).

During the generalization session, the newspaper script had a deteriorating level compared to the treatment phase.

**Grocery Shopping Script**

In the baseline phase, the mean duration of pauses at the beginning of the sentences fluctuated considerably for the grocery shopping script and was characterized by a high level (Table 5), a downward trend, and being variable (42%).

Over the treatment phase, the mean duration of pauses at the beginning of the sentences remained stable (100%) at the level of 3 seconds, with no trend for the grocery script. Compared to the baseline phase, a deteriorating level was observed. In terms of latency, the mean duration
of pauses at the beginning of sentences never fell below that of the baseline phase in the
treatment period.

Throughout the maintenance phase, the participant’s performance displayed an improving
level for the grocery shopping script. An accelerating trend was also noted. Lastly, according to
Table 6, his performance was variable (0%).

In the generalization session, the participant’s performance of the mean duration of
pauses at the beginning of the sentences was 2.3 seconds and displayed a deteriorating level
compared to the maintenance phase.

<table>
<thead>
<tr>
<th>Scripts</th>
<th>Baseline</th>
<th>Treatment</th>
<th>Maintenance</th>
<th>Generalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone Call</td>
<td>4.9</td>
<td>6</td>
<td>3</td>
<td>2.6</td>
</tr>
<tr>
<td>Newspaper</td>
<td>8</td>
<td>8.2</td>
<td>5.8</td>
<td>2.7</td>
</tr>
<tr>
<td>Grocery Shopping</td>
<td>6.5</td>
<td>3</td>
<td>4.4</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Table 5. Mean duration of pauses at the beginning of the sentences per phase per script

<table>
<thead>
<tr>
<th>Scripts</th>
<th>Baseline</th>
<th>Treatment</th>
<th>Maintenance</th>
<th>Generalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phone Call</td>
<td>3.3</td>
<td>6.2</td>
<td>3</td>
<td>N/A</td>
</tr>
<tr>
<td>Newspaper</td>
<td>6.9</td>
<td>7.9</td>
<td>5.8</td>
<td>N/A</td>
</tr>
<tr>
<td>Grocery Shopping</td>
<td>6.1</td>
<td>3</td>
<td>4.4</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Table 6. Median values of the mean duration of pauses at the beginning of the sentences per
phase per script
Figure 5. Mean duration of pauses at the beginning of sentences per phase per script
Western Aphasia Battery-Revised Pre and Post-test Results

<table>
<thead>
<tr>
<th>WAB-R Subtests</th>
<th>Pre-test</th>
<th>Post-test</th>
</tr>
</thead>
</table>
| **Spontaneous Speech** | Information Content Score: 9/10  
Fluency, Grammatical Competence, and Paraphasias’ Score: 9/10 | Information Content Score: 10/10  
Fluency, Grammatical Competence, and Paraphasias’ Score: 9/10 |
| **Repetition** | 97/100 | 90/100 |
| **Naming and Word Finding** | Object Naming: 58/60  
Word Fluency: 13/20  
Sentence Completion: 10/10  
Responsive Speech: 10/10 | Object Naming: 60/60  
Word Fluency: 12/20  
Sentence Completion: 10/10  
Responsive Speech: 10/10 |

Table 7. Western Aphasia Battery-Revised Pre and Post Test Scores

According to the WAB-R pre-test results, during the Spontaneous Speech subtest, JW answered all conversational questions accurately and made an almost complete description of the given picture with relevant sentences. Still, he presented with occasional hesitations, slowness, halted speech, and word-finding difficulties. Also, a semantic paraphasia was present in the Repetition subtest. Lastly, during the Naming and Word Finding subtest, he answered the majority of the questions in the Object Naming, Sentence Completion, and Responsive Speech sections. However, Word Fluency was notably impaired with noted hesitancy. Phonemic cues were indicated to be beneficial at the times he needed cueing.

JW’s WAB-R post-test results (Table 7) indicated that he answered all questions at the Spontaneous Speech subtest with relevant sentences with normal length and complexity, although rare hesitations were noted. During the Repetition subtest, he appeared to be repeating all words and phrases accurately, but he left the 10-words sentence repetition task incomplete after repeating the first five words correctly. He performed faultlessly in the Object Naming, Sentence Completion, and Responsive Speech sections in the Naming and Word Finding subtest.
In summary, JW’s performance at baseline (pre-treatment) was near the ceiling, and his overall performance post-treatment was similar with high scores in most subtests.

*Aphasia Impact Questionnaire (AIQ-21) Post-test Scores*

JW’s AIQ-21 post-test results (see Appendix B) indicated that his language impairment was likely to have a mild impact on activities of daily living. His ratings were all “zeros” (Table 8) except for his response rated as “one” to the question 'How easy was it for you to talk to a stranger?' in a five-point scale questionnaire (0-good to 4-bad).

**IV. DISCUSSION**

The study's primary objective was to replicate the favorable effects of script training intervention on communication effectiveness and communicative efficiency in daily speech with an old-chronic nonfluent aphasia patient (13 years post-onset). Another goal was to evaluate the efficiency of script training on discourse. We implemented a two-week intensive script therapy treatment (30-45 minutes per session) and a supplemental 15-minute homework activity two times a week when he didn't receive therapy.

We anticipated seeing changes in learning following the implementation of script training. General learning effects in regard to PSC (accuracy/effective use of communication) take the form of an increase in the trend, a high level during training compared to baseline. Additionally, we hoped to see this learning effect persist into the maintenance phase even when training was removed, which would look like high mean values, high level, and increasing or stable trend.

Our expectations for efficiency of communication were slightly different. Efficiency may be related to the speed of delivery, such that a communicator may know what they want to say and are ready to say it quickly. JW often hesitated when he spoke, and his labored speech was considered slow by his loved ones. We anticipated he may be faster in baseline than in treatment
because he could rely on his own speech. However, during training, he would slow down as he was learning the script. Eventually, once the script was automated, we anticipated that JW would decrease his duration (possibly beyond his initial baseline time). Then, we anticipated that the reduction in overall duration would continue into the maintenance phase, even after training had been withdrawn, which would look like low mean values, low level, and decreasing or stable trend.

In this section, the outcomes of script training intervention were laid out under two main goals of the study: increasing communication effectiveness and communicative efficiency. Associated dependent variables were presented under the related aim.

**COMMUNICATION EFFECTIVENESS**

Communication effectiveness was dedicated to using the percentage of script-related words in this study (PSC; Youmans et al., 2005). At the end of this study, the participant demonstrated proficiency with all of the scripts and increased the PSC by 60.7% for the phone call script, 98.4% for the newspaper script, and 79.8% for the grocery shopping script.

**Percent Script Correct**

The unequivocal upward trend that was seen shortly after the intervention began implies that the script training intervention had a positive impact on the percent of script-related words for the phone call and newspaper scripts. The data also backs up this claim, with a low level and being stable during the baseline phase and a rising trend with a high level throughout the treatment phase. Moreover, despite removing the intervention, the participant’s use of script-related words continued to increase during the maintenance and generalization sessions. These findings are also consistent with previous research (Goldberg et al., 2012; Youmans et al., 2005),
indicating that the participant had mastered his scripts and was able to deliver all of the target messages as a result of intensive script intervention.

On the contrary, an interruption to the stable trend on the baseline phase of the grocery script was noted in session five. Off the record, the participant reported that he practiced the grocery script during the grocery shopping right before this session. This increase was correlated with this real-life opportunity of practice. Despite the increasing trend during the intervention phase, an unexpected deteriorating level was also noted. Furthermore, the variable data was not convincing throughout the baseline and treatment phases. Therefore, it cannot be concluded that intervention affected percent script-related words. There could be a couple of reasons for this inference. Firstly, the real-life practice might trigger a learning effect. Secondly, since being the last script was taken the intervention phase, repeated baseline probes (seven sessions) are likely to have produced a small learning effect. Szabo et al., (2014) indicated the possibilities for utilizing script content in novel settings or with novel communication partners as an environmental factor that contributes to the success of script training. Even if the aforementioned learning effect existed, the following supposition could be drawn by comparing the mean PSC over phases. During the script training intervention, the participant mastered the grocery script faster than previously during the baseline phase.

Ultimately, the participant demonstrated competency in PSC with all of the scripts, allowing him to communicate the sufficient amount of information conveyed in the scripts.

COMMUNICATIVE EFFICIENCY

Communicative efficiency was dedicated to the time-dependent variables in this study. Namely, the total duration to produce the script and the mean duration of pauses at the beginning of sentences. At the end of this study, the participant demonstrated increased communicative
efficiency with all of the scripts, as is strongly supported by the following data. JW significantly reduced the time it took to complete the phone call script by 18 seconds, the newspaper script by 21.3 seconds, and the grocery shopping script by 26.1 seconds. He also shortened the average duration of pauses at the beginning of sentences in the phone call script by 2.3 seconds, the newspaper script by 5.3 seconds, and the grocery shopping script by 4.2 seconds. Therefore, the participant was able to initiate the script lines more quickly and increase his speaking rate. In a conversation that requires him to apply the trained scripts, he would benefit both from increased rate and quick initiation of speech. To summarize, decreased latency and increased rate would both help in improving communication efficiency.

*The Total Duration to Produce the Script*

Instability in duration was mostly noted in the baseline and treatment phases. We believe this can be accounted for by two main reasons: speed-accuracy trade-off and individual characteristics. The speed-accuracy trade-off refers to how well do individuals with aphasia balance speed and accuracy when the goal is to respond as quickly and accurately as possible during completing a language-dependent task (Evans et al., 2019). Subsequently, individual characteristics include the type and severity of aphasia, as well as concomitant factors (Szabo et al., 2014).

According to Figure 4, the immediacy of the proposed treatment effect occurred towards the end of the treatment phase for the phone call and newspaper scripts. However, prior to that point, we postulated that a speed-accuracy tradeoff may be occurring as the participant managed to learn the script. We hypothesize this based on our observations of the duration data in relation to the accuracy data. In session 8, accuracy was peaking in Figure 3. During the same time, JW’s durations were beginning to decrease rapidly. We concluded the participant had some knowledge
of his phone call and newspaper scripts (but was not yet proficient in them), and he slowed down to gain more accuracy. Following a peak in accuracy, we suspect the script content was automated and allowed the participant to more efficiently deliver the script (i.e., decrease his duration). Unfortunately, the unconvincing data collected during the treatment phase for these scripts prevented us from an inevitable conclusion that script training was the reason for the change in total duration.

Moreover, the duration results could also stem from individual differences. One explanation could be the ability to monitor errors; if a person is unaware of making mistakes, fine-tuning, and changing response thresholds to better balance speed and accuracy would be difficult (Evans et al., 2019). In our case, we believe the participant was overly cautious, which resulted in a longer duration to produce higher percentages of script-related words until the proficiency might occurred. That is to say, while the percent script correct was continually improving, there were substantial fluctuations in the total time it takes to produce scripts.

Moreover, by the time we suggest he achieved automaticity, he had the shortest total script production time and the highest percent script correct.

Additionally, a unique peak point at the third session of the newspaper script needed to be clarified as the participant took his time to read a chapter from a local newspaper during the baseline recording. Szabo et al., (2014) indicate this as one of the individual characteristics that contribute to the success of script training. JW preferred to read for this portion of the script because at that time in his treatment progression it was easier than formulating the speech. Reading was not identified as a weakness in previous reports, and it was not targeted in previous therapies.
Regarding the grocery script, the gradual decrease throughout the baseline phase and the performance being variable suggested that a small learning effect might be present; however, this learning is generalized from the other two scripts. This script was the last script taken into the intervention phase. The unexpected increasing trend during the treatment and maintenance phases, and the unconvincing data of the baseline phase, also verify that the intervention might not be responsible for the change in the total duration of producing the grocery shopping script. Instead, the decrease in duration may have been a global decrease in duration seen across all scripts. A comparison of time spent in treatment does not warrant the learning effect (not script-specific) but a more general learning effect for the duration given that the grocery script was only in treatment for 30 minutes. Szabo et al., (2014) also consider this as a characteristic of intervention that contributes to success.

*Mean Duration of Pauses at the Beginning of Sentences*

Similar to the total duration to produce the scripts, the phone call and newspaper scripts followed a similar pattern in the mean duration of pauses at the beginning of the sentences. Our finding is that if the participant had a basic understanding of his scripts but was not yet fluent in them, he might slow down to enhance his accuracy. It was also supported by the fact that both scripts showed a low level in the baseline phase and a high level in the treatment phase. Also, the low level was sustained during the maintenance and generalization phases. Namely, once the automaticity of the script occurred, the participant was able to sustain it through phases. However, notable fluctuations were observed throughout the baseline and treatment phases, which permits us to only speculate on learning at this time. Additionally, the phone call script had a latency effect; namely, the decline occurred at the fifth session after treatment began. Therefore, the beginning of the change was not wholly attributable to the treatment for these
scripts. In general, the data does not support script-specific learning but may provide evidence of
global learning. Similar to the total duration to produce the scripts, speed-accuracy trade-off, and
individual characteristics should be taken into account while interpreting the data of the mean
duration of pauses at the beginning of sentences.

Regarding the grocery script, although the considerable change in the level between the
baseline and treatment phases, we were unable to conclude that the script training was
responsible for the change in the mean duration of pauses at the beginning of sentences due to
unconvincing performance throughout the baseline phase.

The duration-related data must be looked at with the accuracy-related data in mind.
Comparing the percent script correct with duration-related data, the following should be
emphasized. When the immediacy of effect for PSC occurred during the second treatment
session for the phone call script, JW reached a peak of 87 seconds in duration to achieve 33%
accuracy. This also backs up our assertion that the individual was overly cautious. Subsequently,
by the time he reached a high of 85% accuracy for the phone call script and 95% accuracy for the
newspaper script, the automaticity of the scripts occurred. This resulted in a steep decline to a
total duration of 22 seconds, as well as a low of 0.25 seconds mean duration of the pauses at the
beginning of the sentences for the phone call script. In addition, the newspaper script
demonstrated a significant decrease to a total duration of 19 seconds, as well as a low of 1.2
seconds mean duration of the pauses at the beginning of the sentences. Percent script correct
remained high in the maintenance and generalization phases beyond these sessions, while
duration-related factors remained low for both scripts.
Study Limitations

There were a few limitations to this study. The primary limitation of this study was a two-week break following the first week of intervention due to the participant’s Thanksgiving vacation. Although he met the criteria to initiate a new script right before vacation, the introduction of the third script (grocery script) was withheld until he demonstrated an adequate percentage of accuracy in one more session after the break. Despite this limitation, the learning effects on scripts 2 and 3 were marked, and the participant attended all other sessions throughout the study. The other potential limitation may have been participant frustration, which potentially impacted the duration-related dependent variables. There were a few cases where the participant said, “I don't know” and left the statement unfinished. Another limitation might be the implementation and control of homework. Although the participant was reminded of his homework on the days he has homework, our judgment of whether homework was completed was entirely based on his report.

Additionally, the duration-related dependent variables might cause potential confusions. In fact, the total duration to produce the script and the mean duration of pauses in the beginning of sentences were both latency measurements, therefore they influenced one another. Using “speaking rate” for the total duration to produce the script would be a better alternative to separate these two variables.

Furthermore, while the scripts were created within the context of common opinion, it is possible that minor differences in the scripts impacted how the scripts were learned. For example, the phone call script had a higher total number of words compared to others, and there were semantic interchangeable words in scripts. These factors may have increased the overall complexity of the script. Additionally, the structure of the script also increased complexity. For
instance, the grocery shopping script included three different scenarios that JW encountered while asking for assistance during grocery shopping versus a singular scenario encountered in the other scripts. This also created more flexibility within this script that JW had to adapt to at the moment. Lastly, a control script might have been used to compare the results with the scripts created by the participant. A control script created by the investigator (instead of the participant) would provide insight into the above variables that may have influenced script learning.

Social Validity

The participant was driven throughout the study and was also pleased with his accomplishment once it was over. Occasionally, he has been asked whether he has had the opportunity to practice the scripts in real-life scenarios yet. He reported using the newspaper script with his wife on a regular basis and using the phone call script to get his diabetic strips on his own once. In addition, the participant expressed an interest in using script therapy in his future speech and language therapies. Per request, his script training continues once a week at West Virginia University Speech and Hearing Center.

Future Research

Future research could combine videoconferencing with face-to-face sessions. Unexpected breaks in the study timeline could thus be avoided. As an increasing trend in the field of speech and language pathology, videoconferencing has appeared to be practical and convenient in delivering aphasia therapy in numerous studies (Hall et al., 2013; Rhodes & Isaki, 2018; Woolf et al., 2016). Specifically, Rhodes & Isaki (2018) conducted a study via video conferencing with two nonfluent chronic aphasia patients and found significant improvement in answering yes/no questions, participating in conversations with strangers, and increasing confidence and satisfaction with technology-delivered treatment. Videoconferencing is also included in
numerous script treatment studies in the literature (e.g., Bilda, 2011; Goldberg et al., 2012; Rhodes & Isaki, 2018). Furthermore, videoconferencing enhances the generalization phase of the script treatment (Goldberg et al., 2012).

Further studies can also be conducted to increase the rate of homework completion. There is limited literature that includes videoconferencing merely in the homework part of the treatment in addition to in-person treatment sessions. Thus, further research can address whether videoconferencing has a positive outcome in overall script mastery by increasing the rate of completing script homework or not.

V. CONCLUSION

The effectiveness of script therapy in chronic aphasia, particularly chronic aphasia spanning several years post onset, in terms of communicative effectiveness in daily communication needs to be furtherly investigated. Thus, we implemented a two-week intensive script therapy program with one of our patients who has old-chronic nonfluent aphasia to examine its effects on communicative efficiency and communication effectiveness. The results suggested that people with old-chronic aphasia may increase their communication effectiveness and efficiency, by gaining automaticity after a two-week intensive script therapy. We believe that this research will lead to an increase in the engagement of old-chronic aphasia patients in language therapy in the future. More research is needed to investigate this association, as well as the use of videoconferencing in conjunction with face-to-face sessions during intense script therapy interventions.
APPENDICES

APPENDIX A: SCRIPTS

Phone Call Script: Calling the Pharmacy Regarding Prescription

Pharmacy Technician: CVS Pharmacy, how can I help you today?

JW: Hi, this is XX. I need my prescription filled.

Pharmacy Technician: What prescription do you need filled?

JW: I want to get my diabetic strips refilled.

Pharmacy Technician: What is your date of birth?

*May be asked at any point in this interaction

JW: [says his D.O.B]

Pharmacy Technician: When do you need this filled by?

JW: I need this filled in a couple weeks.

Newspaper Script: Morning Conversation with Wife Over Newspaper

JW: Did you hear about the (basketball, football, or baseball) game?

Wife: No, what happened?

JW: Let me tell you what I read. [talks about what he read].

Wife: That’s nice, dear.

JW: What are you reading?

Wife: I am reading about __________.

JW: That is very interesting!
**Grocery Shopping Script: Asking for Assistance Finding an Item**

JW: Do you know where the ____________ is?

a. Employee response:
   1. They say they have no time
   2. They say they are unsure

JW’s response to either of these: Can you find me someone else who can help?

b. Employee response:
   1. No response
      i. JW: walks away

c. Employee response:
   1. Yes, it is near the __________.
      i. JW: What aisle would that be?

d. Employee response:
   1. Aisle __________.

JW: Thank you.
## APPENDIX B: AIQ-21 PRE AND POST TEST RESULTS

<table>
<thead>
<tr>
<th>Communication</th>
<th>Bad</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Talk-closest</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>2 Talk-stranger</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>3 Understand-closest</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>4 Understand-stranger</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>5 Write a letter to friend</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>6 Read newspaper story</td>
<td>4</td>
<td>3</td>
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</tbody>
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### Participation

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</thead>
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<td>3</td>
</tr>
<tr>
<td>8 Positive things you do</td>
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<td>9 Friends</td>
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<td>3</td>
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<tr>
<td>10 Family</td>
<td>4</td>
<td>3</td>
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### Emotional State/Wellbeing

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<tbody>
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<td>3</td>
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<tr>
<td>12 Worried</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>13 Unhappy</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>14 Helpless</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Bored</td>
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<tr>
<td>---</td>
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<tr>
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<tr>
<td></td>
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</table>

Table 8. Aphasia Impact Questionnaire (AIQ-21) Post-test Scores

*=descriptors reversed within the AIQ scale
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