Discourse Processing Treatment for Adults with Aphasia

by

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The general goal of treatment for people with aphasia (PWA) is to improve their ability to communicate, which involves the discourse level. Treatment at this level is not a new concept, and there are many well-established procedures that utilize the discourse approach.

Deficits that PWA exhibit during conversation are often undetectable by standardized testing. Although these deficits may not be detectable by standardized measures, they significantly impact the PWA's ability to maintain social relationships and engage in everyday communication. Multi-level analyses can identify strengths and weaknesses in PWA's discourse that relate to functional aspects of language processing and structural linguistics. Multi-level discourse analyses have revealed a more productive investigation of discourse production by more thoroughly documenting linguistic abilities in PWA.

The purpose of this study was to determine if using an intensive discourse processing treatment improved discourse production in adults with aphasia. Study aims included a) determining if the discourse processing treatment improved performance on measures of microand macro- linguistic processes for individuals with aphasia for trained and untrained discourse productions, and b) determining if treatment effects were maintained.

Participants included four PWA who met study criteria. The study included three phases: baseline, treatment, and maintenance. Baseline took place during week one of the study, treatment was during weeks two, three, and four, and the maintenance phase included data collection one week after treatment and one month post-treatment. Treatment involved twelve sequential picture stimuli and was administered in a four-step procedure.

A multi-level discourse analyses was applied to analyze changes in PWA communication. Results indicated that the discourse processing treatment resulted in improvements in participant's discourse for trained and untrained productions. The multi-level analysis was more beneficial than standardized measures for analyzing discourse and documenting change in response to treatment.

Discourse Processing Treatment for Adults with Aphasia

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CHAPTER 1: INTRODUCTION

Researchers are interested in improving communication abilities at the discourse level in adults with aphasia. Analysis of discourse production in individuals with aphasia may provide a better way to identify deficits experienced by these individuals that are often not detectable by standardized testing; yet, significantly impact their everyday communication and ability to maintain social relationships. Multi-level analyses can identify strengths and weaknesses related to functional aspects of language processing as well as structural linguistics in discourse of people with aphasia. Treatment at the discourse level has demonstrated improvement in people with aphasia; however, there is a need for additional research-based evidence supporting discourse-based treatment for this population.

Discourse in Aphasia

In an early study investigating discourse-level abilities in people with aphasia (PWA), Lafeuil and Le Dorze (1997) developed a discourse analysis that aimed to quantify word finding difficulty and communication efficiency. Their study included 33 PWA; 17 with recent onset of aphasia (< 1 year) and 16 considered chronic aphasia (>1 year post onset). Participants were presented with single picture stimuli to elicit discourse samples. Lafeuil and Le Dorze analyzed various variables pertaining to the lexical retrieval and content of the samples, measurements of communication efficiency, and duration of the discourse. Lexical retrieval analyses included total number of word finding difficulties and number of each occurrence, and percentage of corrected episodes of word finding difficulties. Sample content analyses included number of total content units and total number of different content units, and also total number of open-class words. Communication efficiency measurements included number of content units and number of different content units expressed throughout the sample.

Lafeuil and Le Dorze (1997) did not find any improvements on standardized aphasia assessment measures when comparing the recent onset group to the chronic group. They also did not find significant improvements in communication efficiency for the chronic group compared to the recent group; and, word finding difficulty did not change, suggesting no significant improvement with lexical retrieval over time. However, improvement in communicative effectiveness seen in production of open-class words per time unit was found from the pre- and post-therapy language sample analyses. Similar findings have been seen in other earlier studies focusing on discourse production in PWA (Prins, Snow, & Wagenaar, 1978; Shewan, 1988). Findings reinforce the need for an analysis that jointly focusses on functional aspects of language processing along with structural linguistics.

Ulatowski, Allard, Reyes, Ford, and Chapman (1992) investigated conversational discourse in people with aphasia through role playing situations in order to provide an analysis system that could be compared to normal participants. The role-playing scenarios were based on situations of conflict and dissatisfaction of a service or product in which the participant role-played as the customer or salesperson.

Participants included five PWA, and six adults without aphasia. Four of the PWA were classified as having non-fluent aphasia and one had fluent aphasia. PWA and the control group were divided into dyads to engage in at least two different role-playing scenarios. They included: 1) PWA with control; 2) PWA with PWA; and 3) control with control. Utterance level measurements included: the number of words, number of linguistic units, number of turns, speech acts, script knowledge, and words and turns per minute. Linguistic units included three types: t-units, words, and phrases (i.e., two or more words but not an utterance). Two types of turns were coded: substantive, which added new information to the conversation, and management turns, which did not add any new information but maintained the flow of conversation. Speech acts included in the linguistic coding were classified as greetings, assertions, evaluations, reflections, suggestions, and/or commitments.

The PWA produced more single-word units, fewer words per turn, fewer clauses per t-unit; and their rate of speech was slower compared to the control participants. The PWA performed similarly to the control participants for number of turns taken and number of speech acts used during the role-playing dyads. Ulatowski et al. (1992) concluded that though the PWA presented with language deficits, their conversational discourse structure was preserved.

By using a modified multi-level discourse processing model developed by Frederiksen and colleagues (Frederiksen, Bracewell, Breuleux, & Renaud, 1990; Frederiksen & Donin, 1991; Frederiksen & Stemmer, 1993), Sherratt (2007) investigated the usefulness of such a model when studying the interaction between procedural discourse and levels of narrative produce by participants with no brain damage. The original model was formulated to identify the various sub-processes associated with the planning of discourse. Modifications were applied in order to incorporate the interaction that takes place between the different levels of discourse and cognitive processes.

The study included 32 non-brain-damaged adult males. Participants completed a combination of 14 narrative and procedural discourse tasks. The tasks included describing picture stimuli, telling about a personal experience (e.g., tell about a frightening experience), and describing a relatively complex procedure (e.g., how to change a tire). A total of 394 discourse samples were obtained. The samples were analyzed in terms of relevance, discourse grammar, clarity disruptors, productivity and syntactic complexity, clausal structure, cohesion, and fluency. Relevance was assessed based on a four-part scale ranging from “inappropriate” to “appropriate”. Discourse analysis was also measured on a scale of appropriateness versus inappropriateness. Clarity disruptors included any non-informative disruptors that made the message less clear. These included non-specific elements (e.g., empty phrases), word substitutions (e.g., paraphasias or circumlocutions), content and fluency disruptors, and total clarity disruptors.

By using the multi-level discourse model, Sherratt found that greater cohesion, relevance, and syntactic complexity were related to more appropriate discourse grammar. Further, larger samples significantly correlated with an increase in syntactic complexity, cohesive ties, and cohesive errors. Sherratt (2007) found that there was a relationship between the increase in non-specific elements and the reduction of syntactic complexity and cohesion. Sheratt (2007) concluded that implementing a multi-level discourse processing model analysis is more realistic and valuable than analyses of individual aspects. Although challenging, multi-level models provide a more productive investigation of discourse production.

Andreetta, Cantagallo, and Marini (2012) investigated the effect of lexical impairments in PWA in relation to their abilities at the discourse level. They applied a multi-level analysis approach and analyzed discourse at the micro-linguistic and macro-linguistic levels. The micro-linguistic level emphasizes lexical and grammatical processing. The macro-linguistic level includes pragmatics and structure.

Ten individuals with anomic aphasia and ten individuals without aphasia were included in the study. Discourse production samples included descriptions of several different picture stimuli; a single picture ("Picnic", Kertesz, 1982) and a series of six picture sequences ("Flower Pot", [Huber & Gleber, 1982] and "Quarrel", [Nicholas & Brookshire, 1993]). Micro-linguistic analyses included productivity, lexical processing, and syntactic encoding. For productivity, the measures included number of words, speech rate, MLU, and number of units—which included all verbalizations despite their linguistic or contextual appropriateness or correctness. The lexical processing measures included the percent of phonological errors produced; false starts, phonological and phonetic paraphasias, and neologisms. Percentage of complete utterances served as the measure for syntactic encoding. The macro-linguistic analyses included percentage of local coherence errors, percentage of global coherence errors, number of thematic units, and percentage of lexical informativeness. Local coherence represents how well each utterance related to the previous utterance. Errors included words without clear referents or erratic topic shifting. Global coherence represents how well the utterances maintained the overall discourse gist/theme. Global coherence errors included utterances that were tangential, conceptually incongruent with the story, repetitions, or fillers. A thematic unit is a concept portrayed within pictured stimuli. Lexical informativeness units (LIUs) included content and function words that are accurate and appropriate for the pictured stimuli; excluding paraphasias, fillers, and tangential utterances.

The results varied depending on the stimulus. Participants with anomic aphasia produced fewer complete utterances for "Quarrel" and "Flower" compared to the control participants, but no group differences were found for the "Picnic" stimuli. For the macro-linguistic measures, the aphasia group produced more global coherence errors but not local coherence errors compared to the control participants. When compared to the controls, PWA also produced a similar number of words but at a reduced rate. Based on the results, Andreetta et al. (2012) concluded that PWA presented with reduced ability for lexical retrieval, increase in errors related to global coherence production, and reduced amounts of lexical informativeness.

Andreetta et al. (2012) concluded that PWA exhibited a reduced rate of speech due to their lexical retrieval impairments; and, global coherence errors that were predominately comprised of repetitions and fillers resulted from the retrieval deficiencies. The PWA did not have problems with identifying concepts; rather, their difficulty with accessing lexical entries may have affected their ability to maintain narrative coherence. Andreetta et al. (2012) further explained that difficulties may result from, “bottom-up processing originating in the process of lexical retrieval rather than from top-down processing concerning the conceptualization of the story” (p.1791).

Marini, Andreetta, DelTin, and Carlomagno (2011) suggested that using standardized measures may not be sufficiently sensitive to detect and assess linguistic deficits and recovery patterns. Marini et al. (2011) applied the same comprehensive, multi-level analysis as Andreetta et al. (2012) to narrative discourse samples produced by two individuals with Wernicke’s aphasia, to evaluate discourse abilities, determine candidacy for specialized therapy, analyze language improvements, and determine relationships between treatment programs and recovery patterns.

The discourse elicitation tasks included four picture stimuli –two single pictures and two sequential pictures. Initial assessment revealed that the participants demonstrated altered verbal productivity, as indicated by decreased speech rate and mean length of utterance (MLU), and high percentage of paraphasias and phonological errors associated with difficulties with lexical retrieval. Deficits with word finding resulted in output characterized by frequent stops and minimal grammatically, well-formed utterances. Results from the multi-level analysis demonstrated that the participants presented with substantial problems with cohesion; in turn, affecting maintenance of local and global coherence and deficits in lexical information units (LIU). Over a course of three assessments, improvement was seen for one PWA on the standardized measure; but the other participant showed no significant increase on the standardized measure. However, both PWA revealed an increase in discourse ability, demonstrated by improved performance on the micro- and macro- linguistic measures.

Marini et al. (2011) concluded that a comprehensive, multi-level analysis is more sensitive for documenting participant's linguistic abilities compared to standardized measures. This procedure is beneficial for discourse analysis for PWA because it encompasses a person's micro- and macro-linguistic abilities in addition to determining communicative and informative skills. When applied to discourse produced by adults with aphasia, this procedure has been useful in providing information about how PWA use their language.

When analyzing discourse production in PWA, researchers have proposed that standardized aphasia assessments reveal minimal to no improvements. However, through multi-level analyses; improvements are demonstrated in communicative effectiveness. Researchers have revealed that although PWA present with language deficits, conversational discourse ability is less impaired. The difficulty with discourse is that the skills that are associated are so multifaceted that a single model may never be enough to accommodate them all (Marshall & Pound, 1997). A range of techniques and analyses need to be applied in order to accurately quantify improvements in PWA.

Discourse Treatment for People with Aphasia

Improving discourse production ability in PWA is not a new concept. The general goal of treatment for PWA is to improve their ability to communicate; which typically involves the discourse level. There are many aspects of discourse that could be targeted for treatment or assessed to evaluate the effects of treatment.

There are several well-defined procedures utilized for treatment at the discourse level in PWA. Promoting Aphasics' Communicative Effectiveness (PACE; Davis & Wilcox, 1985) is one of the most referenced discourse-level treatment procedures. The goal of PACE is to improve conversation for PWA through principles of natural conversational interactions (Davis, 2005). In studies investigating PACE treatment, PWA improved their naming abilities on confrontational naming and narratives tasks (Li, Kistelman, Dusatko, & Spinelli, 1988), communicative effectiveness (Davis & Wilcox, 1985), and referential communication abilities (Carlomagno, 1994; Carlomagno, Blasi, Labruna, & Santoro, 2000). Though PWA made gains in communication abilities with PACE; it was intended for improving conversational exchanges and not narrative productions. Other discourse level treatments include task-specific methods, such as, conversational coaching (Holland, 1991) which involves script training where the PWA incorporates strategies to facilitate communication, and situation-specific training (Hinckley, Carr, & Patterson, 2001; Hopper & Holland, 1998) to teach PWA how to communicate in specific circumstances (e.g., making an emergency phone call). Response Elaboration Training (RET; Kearns, 1985) is another method that can be applied to the discourse level. RET has been used in multiple studies with PWA; treatment stimuli are typically pictures that elicit narratives. Results of studies have included improved performance on aphasia test batteries (Kearns, 1985), increased content production (Kearns, 1985; Wambaugh, Martinez, & Alegre, 2001); and, PWA have demonstrated stimulus generalization as well as maintenance following RET (Kearns, 1985; Kearns & Yedor, 1991).

A case study completed by Osiejuk (1991) investigated the linguistic, cognitive, and discourse changes when utilizing discourse exercises in the treatment of a person with aphasia. E.W., a 53 year old, right-handed male, who suffered from right hemiparesis and severe nonfluent aphasia, began receiving treatment eight months post onset. E.W.'s language was characterized by limited oral expression, limited auditory comprehension, and restricted fluency. The participant attended three 1.5 hour therapy sessions a week for 10 weeks for a total of 30 sessions. Pre-treatment and post-treatment measures were administered three days before and after the beginning and end of therapy.

The main goal of the treatment was to have the participant produce a well-organized discourse. Picture and verbal stimuli were used to elicit narrative and procedural discourse. The picture stimuli included: single scenes; simple and complex; and procedural pictures. The verbal material included fables and descriptions of life events. The participant was instructed to reply to stimuli with a narrative or procedural explanation. Memory recall was later tested by measuring how well the participant could retell the story with no visual or verbal model.

Following treatment, the participant presented with improvements in auditory comprehension and oral expression on standardized language tests. Improvements were evident in the participant's linguistic capabilities as the number of words increased by more than three times. The mean number of conjunctions was comparable to that of a neurologically intact participant, revealing improvement in the participant's utterance complexity. The overall improvement of production did not reduce the number of grammatical and referencing errors.

Discourse analysis post-therapy revealed that E.W. produced a nearly complete superstructure for the story, basic elements for the summary, and complexity through event sequencing actions. The story content included topics present in therapy as well as new information pertaining to a specific day. Procedural discourse production was comparable to that of the neurologically intact participant as well.

Osiejuk (1991) concluded that discourse based therapy can be effective for PWA. E.W was able to produce discourse with complex organization and his production increased in the amount and complexity. The therapy showed to be ineffective for cognitively complex discourse functions, the overall level of intelligence, and reduction of language disturbances including grammatical errors. In order to further validate the use of discourse exercises in treatment with PWA, additional studies should include a larger, more diverse sample and the stimuli should be expanded.

Kempler and Goral (2011) suggested that communication-based therapy for PWA would result in generalization of items and contexts rather than restricted, non-communicative direct treatment effects typically resulting from drill-based exercises. Kempler and Goral (2011) investigated the results of communication based treatment compared to drill-based treatment by comparing the outcomes of two participants with moderately severe, non-fluent aphasia.

Two treatment protocols, titled “Drill” and “Generative”, were administered sequentially resulting in 60 total hours of individual therapy. The goal of each protocol was to increase the participant’s production of appropriate verbs in single sentences. The Drill protocol included a practice set of 64 verbs; 32 of the targets were used each for pre- and post- treatment testing. Various elicitations of the verbs were practiced in treatment, resulting in each verb being practiced approximately 40 times throughout all Drill protocol sessions. The Generative, or communication-based interaction, did not include a preselected list of verbs. The participant was presented picture stimuli and encouraged to produce single sentences that contained verbs which pertained to the actions depicted in the stimuli. The protocol implemented verbal games and communication-based interaction, and the verbs and sentence structures were not rehearsed.

Measurements of verb naming and narrative production, as well as a standardized measurement were administered pre and post each treatment protocol. Verb naming assessment included 96 picture stimuli used elicit verb production in sentences. The narrative analysis measures included lexical, sentence, and discourse. Lexical measures were total number of verbs, total number of different verbs (verb diversity), and total number of correctly produced verb forms. Sentence-level measurement included lexical density of utterances and the formation of complete and grammatical utterances. Discourse measurements of productivity included total number of utterances and total number of words; excluding repetitions, false starts, and interjections. Local and global coherence and story line ratio were analyzed. Story line ratio is described as the number of utterances describing a clear story divided by descriptions related to the background or setting of the narrative.

Kempler and Goral's (2011) final analyses revealed that the communication-based treatment was more effective than drill-based for improving narrative production in PWA. Following the Generative protocol, participant's narratives contained an increase in lexical processes including word production, verb diversity, and verb form accuracy. At the sentence level, participants produced more grammatically correct utterances and more in complete utterances, but there was no change in lexical density. Again, positive results at the discourse level were demonstrated through improvements within local and global coherence. These results were not seen following the drill-based treatment. Verb naming measurements revealed generally positive outcomes while standardized measurements demonstrated minimal increase.

Penn, Jones, and Joffe (1997) investigated the use of a hierarchical discourse-level therapy approach for PWA by implementing the framework developed by Biggs and Collis (1982). Biggs and Collis (1982) suggested that people transition to deeper layers of understanding by completing various defined processes in a hierarchical fashion. A learning sequence demonstrated by learners helped create the SOLO taxonomy defined as Strategies of Observed Learning Outcomes. SOLO includes five levels of learning descriptions: 1) prestructural- no interrelation between question and answer, lays the foundation for more complex skills, 2) unistructural- only one relevant aspect is mentioned, 3) multistructural- several relevant features are mentioned but are not linked, 4) relational- correctly draw general conclusions, and 5) extended abstract- elaborating beyond the given situation and incorporating all relevant information.

Penn et al., (1997) investigated the treatment effect of hierarchical discourse-level treatment for two participants with mild aphasia. The study included five pre- and post-assessments tasks: three letters and expository texts; one interpretation of a poem; and one interpretation of a picture. Participants attended 15 therapy sessions in which clinicians utilized various materials including poetry, political cartoons, advertisements, political debates. All materials aimed to extend the participant's level of response. The responses were analyzed in terms of their SOLO level of learning.

The participants demonstrated a higher level of functioning on all five assessments following treatment. For both participants, a 1-level change occurred for text 1 and 3, and also the interpretation of the poem. One of the participants revealed a 2-level change for text 2, and both participants presented a 2-level change from unistructural to relational for the picture interpretation. Penn et al., (1997) concluded that although their study is preliminary, the use of hierarchical discourse therapy has potential for being a useful tool for treatment and diagnosis. Penn et al., (1997) explained that discourse-based therapy should simultaneously target language and cognition, implement hierarchical and cumulative learning, include meta-linguistic and meta-cognitive processes, and identify strengths and weaknesses of patient's responses.

Hierarchical discourse therapy is a way to address an individual's level of cognitive impairments in treatment programs (Togher, 1997). Such a model is valuable for examining a person's level of functioning in terms of how well they have integrated the information presented to them. In doing so, a more complex level of linguistic output is elicited. By using everyday materials like Penn et al., (1997), PWA perform at higher levels of cognitive integration. A limitation of a hierarchical framework is the nature of how performance is documented (Togher, 1997). The processing scale does not easily reflect significant improvement in PWA performance.

Statement of the Problem

Multi-level discourse analyses provide a better way of identifying deficits in individuals with aphasia that are often undetected by standardized testing. Lafeuil and Le Dorze (1997) conducted a study of 33 participants with aphasia which revealed no improvements with standardized testing but participant's communication effectiveness revealed improvement post-treatment. These results are similar to earlier studies focusing on discourse production in PWA (Prins, Snow, & Wagenaar, 1978; Shewan, 1988). These results reinforce the need for a multi-level analysis that jointly focuses on functional aspects of language processing and structural linguistics. Ulatowski et al., (1992) examined discourse in people with aphasia through role playing scenario and revealed preserved discourse structure in PWA despite the language deficits that they exhibited. Likewise, Sherratt (2007), Andreetta et al., (2012), and Marini et al., (2011) discovered that a multi-level analysis model revealed a more productive investigation of discourse production by more thoroughly documenting linguistic abilities in PWA.

Generally, the goal for treatment for PWA is to improve their ability to communicate which typically involves the discourse level. There are various defined procedures which have been used for treatment at the discourse level in PWA. Some of these include PACE (Davis & Wilcox, 1985), RET (Kearns, 1985), and task-specific methods, such as, conversational coaching (Holland, 1991), or situation-specific training (Hinckley, Carr, & Patterson, 2001; Hopper & Holland, 1998). Studies completed by Osiejuk (1991), Kempler and Goral (2011), Penn et al., (1997), have demonstrated the success of discourse-based treatment in PWA. Although PWA have demonstrated improvement from discourse related treatment, there is a need for more research-based evidence. Additional studies should examine the effects of treatment incorporating cognitive and linguistic components, including participants with varying aphasia severity, and analyzing the effects of discourse treatment when provided in various degrees (e.g., a more intensive treatment design). There is also an additional need for more comprehensive and sensitive outcome measures, such as a multi-level discourse analysis following discourse treatment delivered to individuals with aphasia. Although these types of analyses can be extensive and time consuming, they are much more effective at identifying strengths and weaknesses in a PWA's language when compared to standardized assessments.

The purpose of this study was to determine if using an intensive discourse processing treatment improved discourse production in adults with aphasia. The following research questions were addressed:

1. Does the discourse processing treatment improve performance on measures of micro-linguistic and macro-linguistic processes for individuals with aphasia?
2. Does the discourse processing treatment improve performance on measures of micro-linguistic and macro-linguistics processes for individuals with aphasia to untrained discourse productions?
3. Are treatment effects maintained for one month following treatment?

CHAPTER 2: METHOD

Participants

The study included four participants with aphasia living in the eastern North Carolina area. Participants included adults within the age range of 62 to 86 years who had acquired aphasia secondary to a left hemisphere cerebrovascular accident (CVA). Participant 1 (P1) was an 86 year-old Caucasian male, who was 24 months post onset. He had 21 years of education and worked as an education consultant. Participant 2 (P2) was a 67 year-old Caucasian male who was 240 months (20 years) post onset. P2 had 16 years of education and worked as a store manager at one point. P2 currently works at a local grocery store restocking items. Participant 3 (P3) was a 67 year-old Caucasian female who was 72 months post onset. P3 was disqualified from the study due to her failure to pass the hearing screening during initial testing. Data pertaining to P3 will not be reported. Participant 4 (P4) was a 68 year-old Caucasian male who was 72 months post onset. He is as an antique dealer with 12 years of education. Participant 5 (P5) was a 62 year-old Caucasian female interior designer. She was 24 months post onset and had 17 years of education. All participants were monolingual English speakers. Participants 1, 2, 4 and 5 met the following criteria for participation in the study: a) no more than one cerebrovascular accident (CVA); b) at least 3 months post onset; c) no history of neurodegenerative or psychiatric disorders; d) corrected or uncorrected vision and hearing acuity within normal limits; and e) presence of aphasia. See Table 2.1 for participants' demographic information.

Participants were recruited from East Carolina University's aphasia group and East Carolina University's Speech-Language and Hearing Clinic located in Greenville, North Carolina. During the course of the study, the participants were not enrolled in individual speech-language therapy. Participants were instructed to not attend group therapy during the course of the study, however, P4 and P5 attended one session of group therapy following the treatment phase. All participants were informed of the purpose of the study and their value to it through their continued participation throughout the study.

All participants received a hearing screening to determine that their corrected or uncorrected hearing was within normal limits for participating in the study. Participants completed a sentence repetition task to demonstrate adequate hearing of conversational speech (Davis & Silverman, 1978). Participants also demonstrated normal uncorrected or normal corrected vision by completing a word scanning/cancellation task (Beukelman & Mirenda, 1998).

Western Aphasia Battery-Revised. The *Western Aphasia Battery-Revised* (WAB-R; Kertesz, 2007) aphasia quotient (AQ) subtests were administered to participants to determine the severity of aphasia. The AQ is an overall measurement of oral language comprehension and production severity. The AQ was obtained for each participant. The maximum AQ is 100. It is suggested that a score of 93.8 and below constitutes aphasia (Kertesz, 1982). Subtests included in the AQ calculation were: *spontaneous speech, fluency, comprehension, repetition, and naming*. Participants demonstrated sufficient comprehension to participate in study. Details of participant's WAB-R performances are outlined in Table 2.1.

Communicative Effectiveness Index. The *Communicative Effectiveness Index* (CETI; Lomas et al., 1989) is a rating index that examines the effectiveness of communication comparing abilities after stroke with pre-morbid abilities. Each participant completed the CETI and a significant other/family member for each participant also completed the CETI for self-report and proxy-report of the participant's communicative abilities.

Stimuli Development

Twelve sequential picture stimuli were used during the discourse processing treatment. The stimuli consisted of 4, 6, or 8 pictures. Each sequential picture stimulus was individually edited (adding color) with Microsoft Paint. Comprehension questions were developed for each sequential picture stimuli and thematic units were determined for each sequential picture stimuli.

Comprehension Questions. Comprehension questions were developed following Penn, Jones, and Joffe's (1997) level of processing criteria for response requirement to questions. Question development followed several steps to create and validate them. A graduate student, familiar with the project, developed a total of 75 questions (range 5-7 for each sequential picture stimuli). The questions were randomized and administered to 20 graduate students in Communication Sciences and Disorders who were blinded to the purpose of the study. The students included 20 females between 22-32 years of age. The students were instructed to answer the questions two times, once prior to viewing the picture stimuli and then after viewing the picture stimuli. Prior to the viewing of the stimuli, raters answered the questions to ensure that no questions had an inherent right answer, meaning that the questions could not be answered correctly above chance level without viewing the stimulus or aided by another question. Responses were recorded and scored 0, 1, or 2. A score of 0 indicated an unacceptable answer or a blank response, a score of 1 indicated a partially correct answer, and a score of 2 indicated a fully correct answer. A mean score <1 indicated that raters were not able to answer correctly without the stimulus. A score of 2 indicated the rater was able to answer the question correctly above chance and these questions were eliminated; ensuring that each question was independent of the others. After viewing the pictured stimuli, questions receiving a mean score <1 were eliminated and questions receiving mean score >1 were kept. Raters were asked to provide feedback on the questions as well. Based on feedback, some questions were revised. For example, an initial question, "What happens to the man in the hat?" was changed to "What happens to the man in the brown hat", due to the confusion of two characters in the picture with hats. These questions were re-administered to additional students who did not participate in the initial review of questions. From these results, five to seven comprehension questions were selected for each sequential picture stimulus.

Thematic Units. Following the procedure as developed by Marini, Boewe, Caltagirone, and Carlomagno (2005), thematic units were established for the 12 sequential picture stimuli. Thematic units are considered the main concepts of the story. The thematic units included *elements*, which represented characters depicted, and *actions*, which represented the actions displayed in the stimuli. The units were also coded as essential or details. Essential units were required for a complete narrative and detail units were non-essential but added to the narrative. Scoring criteria for elements included: accurate content; inaccurate content; and missing content. Scoring criteria for actions include: accurate content; inaccurate content; incomplete content; and missing content. (See Appendix B for example sequential picture stimulus with questions and semantic units).

Experimental Design

For the purpose of this study, an ABA design across participants was used. This design was used because it is appropriate for determining if treatment affects the behavior (discourse production ability) when the treatment is applied (Thompson, 2006). This was an intensive study that included three phases: baseline (control), treatment (experimental), and maintenance (control). Dependent measures for treatment and generalization were collected during all three phases. The baseline phase consisted of three trials in week 1. Baseline phase consisted of 12 probes to ascertain stable performance on the dependent measures prior to the experimental phase. Each of the 12 sequential pictures was probed twice. Weeks 2, 3, and 4 consisted of phase two-treatment (experimental). Eight randomly selected sequential pictures were during the treatment phase. Four sequential pictures were probed weekly and served as the untreated targets. For the treatment phase, participants attended three to four times a week for a total of 11 to 12 trials. P1, P4, and P5 all attended 11 sessions of treatment and P2 attended all 12. Each session lasted approximately one hour. The maintenance phase included collection of dependent measures immediately post treatment (week 5) and again one-month post-treatment.

The dependent variables measured during all three phases were the number of thematic units produced in each language sample. All samples were transcribed, segmented into c-units, and randomly checked for reliability. A positive change in number of thematic units would indicate improved discourse abilities and would address the third research question as to whether treatment effects were maintained.

Multi-level Discourse Analysis. To address the first two research questions, “does discourse processing treatment improve performance on measures of micro-linguistics and macro-linguistic processes for trained and untrained items”, a multi-level analysis was completed that examined the participant’s micro- and macro-linguistic processes in discourse. The multi-level discourse analyses included *narrative productivity* and *narrative coherence*.

Narrative productivity considers the functional concern of conveying information in discourse. Narrative productivity measures included units, correct words, and speech rate (words per minute; wpm). The unit count included each word, non-word or syllabic false start uttered by the participant. Correct words were phonologically well-formed words that pertained to the stimuli.

Narrative coherence depends on the ease and extent to which the discourse components go together to represent information and convey intended meanings to the listener (e.g., Glosser & Deser, 1992). Thematic organization and global coherence are methods for measuring coherence and are concerned with the structure of the participant's discourse. Thematic organization connects the productivity and coherence levels of discourse by evaluating the information that should be included to construct a structurally sound narrative discourse. Thematic units, taken as the concepts portrayed in the discourse prompt, assessed thematic organization. The number of thematic units produced served as an index of participants' abilities to derive essential information from the discourse stimulus. Global coherence is maintenance of the gist of discourse and was captured by using percentage of global coherence errors (Marini et al., 2005; Marini et al., 2011) to identify tangential, constructional incongruences, etc. that detract from producing a coherent discourse sample. Errors of global coherence included the production of utterances that were tangential or conceptually incongruent with the discourse, propositional repetitions, or simple fillers.

Procedures

Prior to enrolling in the study, all participants provided informed consent according to East Carolina University's IRB guidelines (See Appendix A). All sessions lasted approximately one hour and took place three to four times a week. Sessions took place at East Carolina University in the Aging and Adult Language Disorders Laboratory located on the second floor of the Health Sciences building or in a suitable room in the participant's home. The rooms were well lit, quiet, and had minimal distractions. Participants were seated at the table across from the clinician. All sessions were video and audio recorded.

Initial Testing. Participants were required to complete medical and educational forms, vision and hearing screenings, WAB-R AQ subtests, and the CETI. Those who met the inclusion criteria for the study, as described earlier, were able to participate.

Baseline probes. Baseline probes consisted of 12 sequential pictures that were administered two times each across three consecutive sessions, with eight pictures administered in each of the three baseline trials. Out of the 12 probes, eight were selected for treatment and four were used as untreated probes. Treated and untreated probes were randomly selected for each participant.

Treatment. A trained clinician administered the discourse processing treatment which included a four-step procedure (See Table 2.2). In Step 1, the clinician presented the picture stimulus to the PWA. While the participant viewed the picture stimulus, the clinician asked questions to probe for level of understanding. Scaffolding, prompting, and repetitions were provided to the participant during responses to ensure that correct information was obtained for the questions. Step 2 included the participant telling the story. The clinician verbally prompted the participant by saying, "Look at the pictures and tell me a story that has a beginning, middle, and end." The PWA was provided with a story guide that contained the following six categories: Setting (who + where), Problem, Internal Response, Action/Plan, Result, and Resolution. The story guide had words and associated pictures (See Figure 2.1). In Step 3, the clinician reviewed the PWA's retelling while using the story guide to elaborate on the participant's story and fill in any missing story elements and details. In Step 4 the PWA retold the story, viewing the stimulus but not the story guide. Steps 1-4 were repeated for each sequential picture stimulus and four stimuli were administered during each treatment session.

Generalization and Maintenance Probes. Generalization was assessed by having the participants complete a different type of discourse elicitation task (procedural). Questions used to elicit the procedural discourse tasks included: 1) How do you mail a letter? 2) How do you plant a flower? and 3) How do you make a peanut butter and jelly sandwich? Participants were told to pretend that they were explaining to someone how to do these three tasks. Generalization probes were completed during the initial baseline phase, immediately after treatment, and one month post-treatment. To determine if participant's language function changed following treatment, the WAB-R AQ subtests were re-administered following treatment. Participants and caregivers also completed the CETI immediately following treatment to determine if communicative efficiency changed post-treatment. The CETI was also re-administered one month post-treatment.

Data Collection. Data collected during baseline, treatment, and maintenance phases included number of thematic units produced. All thematic units (detail/essential actions and detailed/essential elements) were counted. Phonemic paraphasias were not counted. Distortions due to dysarthria or apraxia of speech and self-corrections were counted. Overall thematic unit totals for each picture sequence were determined. Data collection of narrative productivity and narrative coherence were obtained during the baseline phase, immediately post-treatment, and one month post-treatment.

Reliability. All sessions were video and audio recorded. Transcriptions of each session were completed by students experienced in the transcription process. Ten percent of each participant's sessions were randomly selected for review for inter- and intra-rater agreement for transcription, c-unit segmenting, and scoring thematic units. Rater agreement exceeded 90% reliability. Any discrepancies were resolved through discussion.

The clinicians followed a study checklist to ensure procedures were followed during baseline, treatment, and maintenance phases. Additionally, an independent observer, who was trained in the discourse processing treatment procedures, viewed 10% of randomly selected trials from each participant's baseline and treatment sessions to ensure that the examiner followed the procedures appropriately. Procedural reliability exceeded 90%.

CHAPTER 3: RESULTS

Data for the multi-level discourse analyses were collected at baseline, immediately post-treatment, and one-month post treatment. The multi-level analyses included narrative productivity and narrative coherence. Data collection for narrative productivity included units, correct words, and speech rate. The following were included in the unit count; each word, non-word and syllabic false start uttered by the participant. Correct words were counted as phonologically well-formed words that pertained to the stimuli.

Data collection for narrative coherence included thematic units and global coherence errors. Thematic units served as the dependent measure and were collected in all three phases of the study (baseline, treatment, and maintenance). Errors of global coherence included the production of utterances that were tangential or conceptually incongruent with the discourse, repetitions, and simple fillers.

Due to technical difficulties, video and audio data were unavailable for portions of P2's initial baseline and all of P4's initial baseline. Results were reported on data that were available for analysis.

Narrative Coherence

Thematic Units. Results are presented in Table 3.1 showing the total number of correct thematic units produced for each trained and untrained picture stimuli. Data are presented for baseline, and maintenance conditions of the study; however, data collection of trained stimuli took place during the treatment phase. Following the procedure developed by Marini, Boewe, Caltagirone, and Carlomagno (2005), thematic units were established for all 12 sequential picture stimuli, resulting in 236 total elements. For the baseline phase, which consisted of three sessions, participants were administered all 12 pictures, two times each. This resulted in eight pictures being administered each day of the baseline phase. At the beginning of each treatment week, participants were administered eight randomly selected sequential picture stimuli which served as the treated probes. Four pictures were administered during each treatment session. During the maintenance phase (immediately post-treatment and one-month post-treatment), all 12 sequential picture stimuli were administered in order to monitor changes for treated and untreated stimuli.

Participant 1.An initial baseline mean for trained stimuli of 26.3% was established for P1, which included production of total thematic units. Following baseline, treatment began for eight randomly selected sequential pictures. Over the course of the three-week treatment phase, P1's results were as follows: 50%; 56.6%; and 44.6%. P1's immediate follow up result was 52.6% accuracy, and at his one-month post-treatment follow-up he obtained 33.3% accuracy. Following treatment, P1 demonstrated an increase for the number of correct thematic units produced, however, this improvement was not maintained at his one-month follow-up.

An increase in production of thematic units was observed for all four of the untreated probes following treatment, however results were not maintained one-month post-treatment. For the first untreated probe P1 achieved baseline accuracies of 5% and 20%. The accuracy increased to 30% immediately following treatment. For the one-month follow-up, P1's accuracy decreased to 10%. P1's second untreated probe went from 40% and 30% during baseline, to 45% accuracy immediately post-treatment, and down to 25% for the one-month follow-up. Baseline accuracies for the third untreated probe were 4.17% and 0% with an increase of 20.83% immediately post-treatment. P1's accuracy then fell back to 12.5% one-month post-treatment. The fourth untreated probe demonstrated similar results. P1 demonstrated an increase from baseline accuracies (9.09% and 18.18%) to immediate post treatment accuracy (36.36%), then a decline one-month after treatment (31.82%). Overall, for untrained stimuli, P1's mean baseline, immediate follow-up and one-month follow-up results were 15.1%; 32.5%; and 19.5% respectively. Refer to Table 3.1 for thematic unit means.

Participant 2. An initial trained stimuli baseline mean of 37.3% was established for P2, which included production of total thematic units. Following baseline, treatment began for eight randomly selected sequential pictures. Over the course of the three-week treatment phases, P2's results were as follows: 26.5%; 43.3%; and 43.3%. P2's immediate follow up result was 52.6% accuracy, and at his one-month post-treatment follow-up he obtained 53.7% accuracy. Following treatment, P2 demonstrated an increase for the number of correct thematic units produced, and the improvement was maintained at his one-month follow-up.

Increases in production of thematic units for untrained probes were inconsistent for P2. For the first untreated probe P2 achieved baseline accuracies of 28.57% and 38.10%. Immediately following treatment, P2's accuracy for the first untreated probe remained at baseline level, 28.57%. However, for the one- month follow-up, P2's accuracy increased to 42.86%. P2's accuracies for the second untreated probe were 7.69% and 38.46% during baseline. His accuracy remained at 38.46% for the immediate and one month follow-up, indicating no improvement. For the third untreated probe, at baseline, P2 produced 30.77% and 76.92% accuracy. Accuracy for the immediate and one-month follow-up for the third untreated probe were 69.23% and 61.54% respectively. Baseline accuracies for the fourth untreated probe were 31.25% and 43.75%. P2 demonstrated baseline accuracy immediately following treatment, 43.75%; however, and increase was demonstrated one-month post-treatment, 50% accuracy. Overall, P2's untrained baseline mean was 36.5%. Overall improvements were demonstrated as

P2 increased production to 42.8% immediately after treatment and continued to increase to 47.7% one-month after treatment. Refer to Table 3.1.

Participant 4. An initial treated baseline mean of 15.2% was established for P4, which included production of total thematic units. This baseline was lower than the other three participants. Over the course of the three-week treatment phases, P4's results were as follows: 24.2%; 30.5%; and 19.7%. Immediately following treatment P4's production increased to 40.1%. At the one-month post-treatment follow-up he obtained 20.3% accuracy. Following treatment, P4 demonstrated an increase for the number of correct thematic units produced. Although P4's production at the second follow-up was not as high as the initial follow-up, it was still improved compared to his baseline level.

For P4, improvements were demonstrated on three of the four untreated probes following treatment, however improvements were not maintained. For the first untreated probe P4 achieved baseline accuracies of 9.52% and 14.29%. Immediately following treatment, P4's accuracy for the first untreated probe increased to 23.81% accuracy. However, for the one- month follow-up, P4's produced zero thematic units, falling below baseline accuracy for the first untreated probe. P4's accuracies for the second untreated probe were 15.38% and 38.46% during baseline. His accuracy increased to 46.15%% for the immediate follow-up, and decreased to baseline measures (15.38%) for the one-month follow-up. For the third untreated probe, at baseline, P4 produced 10% and 15% accuracy. Accuracy for the immediate and one month follow-up for the third untreated probe were 25% and 20% respectively; indicating improvements following treatment that were not maintained one-month post-treatment. Baseline accuracies for the fourth untreated probe were 8% and 20%. P4 demonstrated near baseline accuracy immediately following treatment and one month post-treatment, 12% and 8% respectively. P4's overall mean baseline for untreated stimuli was 15.2%, which was actually the same as treated stimuli. At the initial follow-up P4's overall production of thematic units for untrained items increased to 24%. However, at the one-month follow-up, overall production decreased to 10.1% which was below the baseline mean.

Participant 5. An initial baseline mean for treated stimuli of 33% was established for P5, which included production of total thematic units. Over the course of the three-week treatment phases, P5's results were as follows: 38.6%; 52.9%; and 63.6%. P5's immediate follow up result was 54.1% and at her one-month post-treatment follow-up was 69% accuracy. Following treatment, P5 demonstrated an increase for the number of correct thematic units produced and her production continued to increase one-month after treatment.

Increase in production of thematic units was observed on all four untrained stimuli for P5. For the first untreated probe, she achieved two baseline accuracies of 15.38%. Immediately following treatment, P2's accuracy for the first untreated probe increased to 38.46% and continued to increase to 61.51% accuracy one-month after treatment. P5's accuracies for the second untreated probe were 46.15% and 69.23% during baseline, and 53.85% accuracy immediately post-treatment. Although P5 didn't exhibit improvement for the second treated probe immediately after treatment, her accuracy for the one-month follow-up significantly increased to 100%, meaning that she produced the total amount of thematic units for that sequential picture stimuli. For the third untreated probe, P5 produced 35% and 40% accuracy at baseline. Accuracy for the immediate and one-month follow-up for the third untreated probe were 30% and 85% respectively. This indicated that for the third untreated probe, P5's production of thematic units fell below the baseline accuracy immediately after treatment, but she then exhibited significant improvement one month post-treatment. Baseline accuracies for the fourth untreated probe were consistently 36.36%. She demonstrated increasing improvement immediately and one-month post treatment (45.45% and 68.18% accuracy). Overall, P5's baseline mean for untrained stimuli was 36.7%. At the immediate follow-up, P5's overall production slightly increased to 41.1%. At the one-month follow-up, her production of thematic units significantly increased to 77.9%.

Treatment Effect Size. Following instructions from Beeson and Robey (2006), the treatment effects were calculated for each participant for mean thematic units produced for treated and untreated stimuli. Calculations included baseline percentage of thematic units produced and compared them to the post-treatment measurement (including immediate follow-up and one-month follow-up). Effect size was obtained by averaging the percent of thematic units produced during phase A1 (baseline) and phase A2 (post-treatment), subtracting A1 average from A2 and dividing by the standard deviation of A1. For the treated stimuli, two baseline trials were included for P1, P2, and P5, and one trial was included for P4 (due to lost data). For the untreated stimuli, phase A1 included two baseline trials for all participants and two A2 maintenance trials.

For the treated stimuli, P1, P2, P4 and P5 respectively obtained the following effect sizes: 5.1, 0.7, 0.9, and 22.4. Based on Beeson and Robey's (2006) interpretations, P2 and P3 demonstrated small treatment effects for the treated stimuli, P1 demonstrated a medium effect, and P5 demonstrated a large effect (small=2.6, medium=3.9, large= 5.8). For the untreated stimuli, P2, P2, P4, and P5 respectively obtained the following effect sizes: 6.7, 0.5, 0.4, and 3.6. Interpretations of treatment effects varied for treated and untreated stimuli. Based on Beeson and Robey's (2006) interpretations, for the untreated stimuli P2, P4, and P5 all demonstrated small treatment effects, and P1 demonstrated a large effect size. Details of treatment effects for treated and untreated stimuli are depicted in Table 3.1.

Global Coherence Errors. Global coherence errors included tangential and conceptually incongruent utterances, repetitions, and simple fillers. Data collection for global coherence errors was completed during baseline, immediately post-treatment, and one month post-treatment. Baseline and maintenance means were calculated for each participant based on available data. Results for treated and untreated stimuli are presented in Table 3.2 for each participant.

Participant 1. The overall mean of global coherence errors included repetitions, simple fillers, and incongruent and tangential utterances and was calculated for baseline, immediately post-treatment, and one-month post-treatment. The mean measures of global coherence produced for the treated stimuli for P1 during baseline, immediate follow-up, and one-month follow-up was 7.8, 3.3, and 7.3, respectively. Following treatment, P1's overall production of global coherence errors declined. However, one month after treatment, results increased to near baseline levels. Refer to Figure 3.1

The overall mean of global coherence errors produced for untreated stimuli for P1 during baseline, immediate follow-up, and one-month follow-up were 9.7, 5.0, and 4.7, respectively. Results demonstrated a continuous decline in production of global coherence errors for untreated stimuli following treatment. Refer to Figure 3.1.

Participant 2. The overall mean of global coherence errors included repetitions, simple fillers, and incongruent and tangential utterances and was calculated for baseline, immediately post-treatment, and one-month post-treatment. The mean measures of global coherence produced for the treated stimuli for P2 during baseline, immediate follow-up, and one-month follow-up was 4.5, 4.0, and 3.8, respectively. Immediately following treatment, P2's overall production of global coherence errors declined for treated stimuli. Production continued to decrease one-month after treatment. Refer to Figure 3.1

The overall mean of global coherence errors produced for untreated stimuli for P2 during baseline, immediate follow-up, and one-month follow-up were 4.2, 2.2, and 1.0, respectively. Results demonstrated a continuous decline in production of global coherence errors for untreated stimuli following treatment. Refer to Figure 3.1.

Participant 4. The overall mean of global coherence errors included repetitions, simple fillers, and incongruent and tangential utterances and was calculated for baseline, immediately post-treatment, and one-month post-treatment. The mean measures of global coherence produced for the treated stimuli for P4 during baseline, immediate follow-up, and one-month follow-up were 2.2, 2.2, and 2.0, respectively. Result indicated minimal change in production of global coherence errors after treatment. Refer to Figure 3.1.

The overall mean of global coherence errors produced for untreated stimuli for P4 during baseline, immediate follow-up, and one-month follow-up were 4.2, 2.5, and 2.5, respectively. Results demonstrated a decline in production of global coherence errors for untreated stimuli following treatment, and effects were maintained one-month after treatment. Refer to Figure 3.1.

Participant 5. The overall mean of global coherence errors included repetitions, simple fillers, and incongruent and tangential utterances and was calculated for baseline, immediately post-treatment, and one-month post-treatment. The mean measures of global coherence produced for the treated stimuli for P5 during baseline, immediate follow-up, and one-month follow-up was 4.8, 2.6, and 2.8, respectively. P5's overall production of global coherence errors declined for treated stimuli following treatment. Refer to Figure 3.1.

The overall mean of global coherence errors produced for untreated stimuli for P5 during baseline, immediate follow-up, and one-month follow-up were 4.5, 5.5, and 3.0, respectively. Although the results at the immediate follow-up were increased compared to baseline, based on P5's one-month follow-up, treatment was successful in decreasing the number of global coherence produced. Refer to Figure 3.1.

Narrative Productivity

Narrative productivity measures included units, correct words, and speech rate. Unit count included all words, non-words, and false starts. Correct words pertained to phonologically well-formed words that pertained to the stimuli. Speech rate was measured in terms of words per minute (wpm). Narrative productivity means were calculated for baseline, initial follow-up, and one-month follow-up for treated and untreated stimuli. Refer to Table 3.3.

Participant 1. An initial narrative productivity baseline was established for P1 across three trials, which included units, correct words, and speech rate. Data was collected again immediately after treatment and one month post-treatment. P1's mean baseline for units produced for treated stimuli was 78.8. Immediately post-treatment P1's mean production of units was 131.3, and one-month-post treatment it was 129.8, demonstrating positive treatment effects. Following treatment, P1's speech rate increased from baseline mean 44.5 to 62.7wpm. P1's speech rate was 48 wpm at the one-month follow-up. Although P1's speech rate decreased from the immediate and one month follow-up, results at the one-month follow-up were still higher than baseline levels indicating that treatment effects were maintained. P1's production of correct words for treated stimuli continuously increased following treatment. His baseline average was 35.4 correct words. This increased to 60.8 correct words immediately post-treatment, to 78.8 correct words one-month post-treatment.

Treatment effects for P1 were similar for treated and untreated stimuli. At baseline, P1 averaged 65.3 units for untreated stimuli. He demonstrated a continuous increase in mean production of units following treatment. Results for immediate and one-month follow-up were 120.0 and 163.0 respectively. P1 produced 34.8 wpm at baseline, 64.3 wpm immediately after treatment, and 54.2 one-month after treatment. Mean production of correct words during baseline, immediate follow-up, and one-month follow-up for untreated stimuli were 35.4, 60.8, and 78.8 respectively. Following treatment, P1 significantly increased his production of correct words pertaining to the untreated stimuli.

Participant 2. P2's initial baseline for narrative productivity was established across three trials and included units, words, speech rate and mean c-unit length. Additional data collection took place immediately after treatment and one month post-treatment. Data was unable to be reported for P2's initial baseline session. P2's mean baseline for units produced for treated stimuli was 86.1. Immediately post-treatment P2's mean production of units was 127.8, and one-month-post treatment it was 124.8; demonstrating positive treatment effects. Following treatment, P2's speech rate increased from a baseline mean 48.8 wpm to 72.4 wpm. P2's speech rate was 63.3 wpm at the one-month follow-up. P2 demonstrated positive increase in speech rate following treatment and effects were maintained one month after treatment. P2's production of correct words baseline average was 51.5 for treated stimuli. He increased the production of correct words to an average of 85 correct words immediately post-treatment and 71.8 correct words one-month post-treatment.

P2 demonstrated improvements on production of units and speech rate for untreated stimuli. At baseline, P2 averaged 21.5 units for untreated stimuli. Results for immediate and one-month follow-up were 79.2 units and 78.2, respectively. P2 produced 50.4 wpm at baseline, 58.5 wpm immediately after treatment, and 57.5 one-month after treatment. P2's results revealed that improvements in speech rate were not as substantial for the untreated stimuli as they were in the treated stimuli. Mean production of correct words during baseline, immediate follow-up, and one-month follow-up for untreated stimuli were 58.3, 53.2, and 47.2, respectively. Production of correct words was the only narrative productivity measurement for untreated stimuli that P2 did not demonstrate improvements post-treatment.

Participant 4. Initial baseline for narrative productivity was established for P4 across three trials and included units, correct words, and speech rate. Additional data collection took place immediately after treatment and one month post-treatment. P4's mean baseline for units produced for treated stimuli was 48.51. Immediately post-treatment P4's mean production of units was 89.8, and one-month-post treatment it was 81.5; demonstrating positive treatment effects that were maintained one month after treatment. Following treatment, P4's speech rate increased from baseline mean of 55.5 wpm to 77.8 wpm. P4's speech rate was 68 wpm at the one month follow-up. P4 demonstrated positive increase in speech rate following treatment and effects were maintained one month after treatment. P4's production of correct words baseline average was 25.5 for treated stimuli. He largely increased the production of correct words to an average of 60.6 correct words immediately post-treatment and 50.0 correct words one-month post-treatment.

P4 demonstrated improvements on production of units and speech rate for untreated stimuli. At baseline, P4 averaged 36 units for untreated stimuli. Results for immediate and one-month follow-up were 59.7 units and 60.5, respectively. P4 produced 49.7 wpm at baseline, 38.8 wpm immediately after treatment, and 58.0 one-month after treatment. Although P4's speech rate decreased immediately after treatment at the one-month follow-up he demonstrated improvements. Mean production of correct words during baseline, immediate follow-up, and one-month follow-up for untreated stimuli were 18.7, 38.7, and 30.7, respectively.

Participant 5. Initial baseline for narrative productivity was established for P5 across three trials and included units, words, speech rate and mean c-unit length. Additional data collection took place immediately after treatment and one month post-treatment. P5's mean baseline for units produced for treated stimuli was 91.6. Immediately post-treatment P5's mean production of units was 150.2, and one-month-post treatment it was 174.6; demonstrating continuous improvements post-treatment. Following treatment, P5's speech rate slightly increased from a baseline mean 64.7 wpm to 69.0 wpm. P5's speech rate was 56.8 wpm at the one-month follow-up, which was below her baseline. Therefore, slight improvements were noted immediately after treatment but the effects were not maintained one month after treatment. P5's production of correct words at baseline averaged to 41.4 for treated stimuli. She significantly increased the production of correct words to an average of 90.8 correct words immediately post-treatment and 95.0 correct words one-month post-treatment.

P5 demonstrated improvements on production of units and correct words for untreated stimuli. At baseline, P5 averaged 80.3 units for untreated stimuli. Results significantly increased to 152.0 units immediately after treatment and continued to increase to 165.5 units one-month after treatment. P5 produced 69.1 wpm at baseline, 55.2 wpm immediately after treatment, and 65.6 one-month after treatment. Treatment was not effective in increasing P5's speech rate. Mean production of correct words during baseline, immediate follow-up, and one-month follow-up for untreated stimuli were 40.7, 83.2, and 95.2, respectively. Production of correct words continuously increased after treatment.

Generalization

Measures of narrative productivity and narrative coherence were applied to the three procedural discourse tasks in order to analyze generalization effects to a different discourse genre. The probes included the questions, “how do you mail a letter?”, “how do you plant a flower?”, and “how do you make a peanut butter and jelly sandwich?” The three generalization probes were administered one time during baseline, during the immediate follow-up and during the one-month follow-up.

Participant 1. By using responses from the three procedural questions, means were calculated for generalization probes. Narrative productivity measures included mean production of units, correct words, and speech rate (wpm). P1’s production of units for baseline, immediate follow-up, and one-month follow-up were 112, 87.6, and 119 respectively. P1’s wpm means for baseline, immediate follow-up and one-month follow-up were 68.4, 72.8, and 56.4, respectively. P1’s mean production of correct words from baseline, immediate follow-up and one-month follow-up were respectively 25.3, 39.3, and 46.6 correct words.

Narrative coherence included production of global coherence errors. For the generalization probes, P1’s mean global coherence error production for baseline, immediate follow-up and one-month follow-up were 9.3, 3.0, and 7.3. Based on P1’s results, treatment was effective in reducing the overall production of global coherence errors for generalization probes. Although the mean increased from the immediate follow-up to the one-month follow-up, results one month after treatment were still below baseline levels; indicating maintained treatment effects.

Participant 2. By using responses from the three procedural questions, means were calculated for generalization probes. P2's production of units for baseline, immediate follow-up, and one-month follow-up were 35.3, 43.6, and 49.6, respectively. P2's wpm means for baseline, immediate follow-up and one-month follow-up were 61.3, 59.0, and 43.1, respectively. P2's mean production of correct words from baseline, immediate follow-up and one-month follow-up were respectively 29, 35.3, and 43.6 correct words.

Narrative coherence included production of global coherence errors. For the generalization probes, P2's mean global coherence error production for baseline, immediate follow-up and one-month follow-up were 1.3, 1.6, and 1.3.

Participant 4. By using responses from the three procedural questions, means were calculated for generalization probes. Narrative productivity measures included mean production of units, correct words, and speech rate (wpm). P4's production of units for baseline, immediate follow-up, and one-month follow-up were 63.3, 56.0, and 56.6 respectively. P4's wpm means for baseline, immediate follow-up and one-month follow-up were 64.3, 51.3, and 74.1, respectively. P4's mean production of correct words from baseline, immediate follow-up and one-month follow-up were respectively 39, 33.3, and 39.3 correct words.

Narrative coherence included production of global coherence errors. For the generalization probes, P4's mean global coherence error production for baseline, immediate follow-up and one-month follow-up were consistently 1.6.

Participant 5. By using responses from the three procedural questions, means were calculated for generalization probes. Narrative productivity measures included mean production of units, correct words, and speech rate (wpm). P5's production of units for baseline, immediate follow-up, and one-month follow-up were 35.6, 93.6, and 41.6, respectively. P5's wpm means for baseline, immediate follow-up and one-month follow-up were 74.4, 86.3, and 109.8, respectively. P5's mean production of correct words from baseline, immediate follow-up and one-month follow-up were respectively 29.0, 65.0, and 26.3 correct words.

Narrative coherence included production of global coherence errors. For the generalization probes, P5's mean global coherence error production for baseline, immediate follow-up and one-month follow-up were 0.6, 1.0, and 0.6. A slight increase in production of global coherence errors was observed for P5's generalization probes immediately after treatment. One-month after treatments, her production was the same as baseline.

Western Aphasia Battery-Revised

Participants were administered the AQ subtests of the WAB-R during initial testing and immediately following treatment. Three of the participants demonstrated small improvements on the AQ scores following treatment. P1 increased from an AQ of 87.2 to 88.9. P2 demonstrated the largest increase from a 75.9 to a 78.2. P4 demonstrated a decline in AQ score following treatment. He went from an AQ of 81.4 to 77.6. P5 increased .4 points, changing from an 82.5 to an 82.9. The range of increase on the WAB-R following treatment was 1.9 points. Summary of WAB-R scores are depicted in Table 3.4.

Communicative Effectiveness Index

Participants and participant's family members completed the Communicative Effectiveness Index (CETI) three times throughout the course of the study: during initial testing; immediately following treatment; and one-month post-treatment. The CETI included 16 analog scale questions that are based on various communication categories such as basic needs and social needs. Question 17 of the CETI has participants/family members circle a number from a scale of 1-7 (extremely poor to excellent) that reflects overall communication abilities within the last week. Data from question 17 were not included in analyses. Once all forms were completed, clinicians scored each question by measuring in millimeters (mm) the individuals rating (range= 0-100 mm for each question). Means for each CETI form were calculated.

For participants' completion of the CETI, P2, P4, and P5 recorded improvements from initial testing to immediately following treatment. P2 increased from 58 to 66, P4 demonstrated a slight increase from 55 to 58, and P5 changed from 78 to 83. P2 recorded a decline from 65 to 57. All four participants demonstrated perceived improvements from initial testing compared to one month post-treatment. P1 went from 65 to 83, P2 went from 58 to 62, P4 went from 55 to 69, and P5 went from 78 to 86. When comparing immediate post-treatment results to the one-month follow up, three participants reported improvements in their perceived communication effectiveness. P1 went from 57 to 83, P4 went from a 58 to 69, and P5 went from 83 to 86. P2 demonstrated a slight decline, 66 to 62.

When comparing initial CETI results to results measured immediately post-treatment based on family member's reports, slight improvements were observed for all participants. P1 increased from 41 to 54, P2 increased from 33 to 45, P4 increased from 51 to 54, and P5 increased from 42 to 51. When comparing initial results to results from the one-month follow-up, slight improvements were also noted for all participants. P1 increased from 41 to 53, P2 increased from 33 to 34, and P4 increased from 51 to 52. The family member's one-month post-treatment CETI form for P5 was not received; therefore comparison data involving that form could not be completed. Detailed description of CETI results are depicted in Figure 3.2 and Figure 3.3.

CHAPTER 4: DISCUSSION

The general goal for PWA is to improve their ability to communicate, which typically occurs at the discourse level. Focus on the discourse level for treatment for individuals with aphasia is not a new concept. Promoting Aphasic's Communicative Effectiveness (PACE; Davis & Wilcox, 1985), Response Elaboration Training (RET; Kearns, 1985), and conversational coaching (Holland, 1991) are a few of the well-established procedures that treat communication impairments at the discourse level.

Ulatowska and colleagues (1992) found that following discourse treatment, participant's with aphasia presented with language deficits as indicated by performance on standardized measures; however, conversational discourse ability improved. By analyzing discourse produced by PWA, deficits that are often undetectable by standardized assessments can be identified. It is important that these deficits are identified as they significantly affect the PWA's ability to engage in everyday conversation and maintain social relationships.

By applying multi-level analyses to discourse samples of PWA, strengths and weaknesses relating to functional aspects of language processing and structural linguistics can be identified. Previous researchers that examined communication in PWA (Lafeuil & Le Dorze, 1997; Prins, Snow, & Wagenaar, 1978; Shewan, 1988) supported the need for analyses that jointly incorporate aspects of micro- and macro- linguistics. Marini, Andreetta, del Tin, and Carlomagno (2011) developed a multi-level discourse analysis for use with PWA. They concluded that the multi-level analysis captured improvements in the PWA's language and communicational skills that standardized tests cannot.

In the current study, an ABA design across participants was used in order to maintain experimental control. The study included three phases: baseline, treatment, and maintenance. Baseline phase took place during week one, the treatment phase took place during weeks two, three, and four, and the maintenance phase included a follow-up immediately post-treatment, and a one month post-treatment follow-up. The current study applied multi-level analyses to measure changes in discourse production following the discourse processing treatment. The multi-level analyses included measures of narrative productivity and narrative coherence. The narrative coherence measure that was used throughout the study and was analyzed to determine treatment effect size for treated and untreated stimuli was thematic units. All participants produced more thematic units following the discourse processing treatment for treated and untreated stimuli. All participants maintained treatment effects one-month after treatment for treated stimuli, indicating that the production of thematic units was higher at the one-month follow-up than they were at baseline. Three participants maintained treatment effects one-month after treatment for the untreated stimuli; however, at the one-month follow-up, P4's production of thematic units fell below baseline. Participants' improved on measures of narrative productivity and global coherence following treatment, but level of improvement and level of maintenance varied across participants for trained and untrained stimuli. Participant and proxy reports on the CETI indicated positive change following treatment. Significance of change varied, but all reports indicated maintenance. None of the participants experienced meaningful changes on the standardized aphasia test battery, the WAB-R. In the following sections, results of the study are discussed.

Multi-Linguistic Processes after Treatment

Overall, results following the discourse processing treatment revealed that all four participants produced more thematic units during discourse following treatment for treated and untreated stimuli. By producing more thematic units following treatment, participants were able to better convey essential information depicted in the picture and produce more complete stories. Based on Beeson and Robey's (2006) interpretations, P2 and P4 demonstrated a small treatment effect size for treated stimuli, P1 demonstrated a medium effect size, and P5 demonstrated a large effect size. For the untreated stimuli, all participants increased production of thematic units immediately following treatment. Based on Beeson and Robey's (2006) interpretations, P2, P4, and P5 demonstrated small treatment effect sizes for untreated stimuli, and P1 demonstrated a large treatment effect size.

In addition to thematic units, narrative coherence included global coherence errors. Global coherence errors included incongruent and tangential utterances, fillers, and repetitions. These errors can affect the flow of the story negatively impact the overall "gist". In addition, they difficult for listener to follow the discourse produced. By decreasing the production of global coherence errors, the burden on the listener to follow the discourse improves. Following treatment, none of the participants decreased production of repetitions for the treated stimuli. For the untreated stimuli, only P4 slightly decreased repetitions. For the treated and untreated stimuli, P1 and P4 were the only participants who decreased fillers immediately following treatment. For treated stimuli, P2 and P5 decreased their incongruent utterances produced. No participants decreased incongruent utterances following treatment for untreated stimuli. For production of tangential utterances, P1, P2, and P5 decreased productions for treated stimuli. P4 consistently produced zero tangential utterances during baseline and immediately after treatment. For the untreated stimuli, P1 and P4 decreased production, and P2 maintained at zero. Following treatment, P1, P2, and P5's overall production of global coherence errors decreased for treated stimuli; P4's production was unchanged. P1, P2 and P4, all decreased overall production of global coherence errors following treatment for untreated stimuli.

Narrative productivity measures included units, correct words, and speech rate. The target goal in terms of narrative productivity was to increase measures. By increasing measures of narrative productivity PWA's discourse is characterized by more content, more relevant information, and it is conveyed in a more timely fashion. Production of units for treated and untreated stimuli increased for all participants following treatment. All participants increased speech rate for treated stimuli. P1 and P2 increased speech rate following treatment for untreated stimuli. All participants increased production of correct words pertaining to treated stimuli following treatment. Following treatment, P2 was the only participant who did not increase production of correct words pertaining to untreated stimuli.

Maintenance of Treatment Effects

Maintenance varied across multi-linguistic measures for participants. For the treated stimuli, all four participants maintained treatment effects one month after treatment for production of thematic units. Participant 2 and 5 continued to improve from the immediate follow-up compared to the one-month follow-up. These participants may have continued to demonstrate improvements due to their higher levels of involvement in the community compared to the other participants, for instance both participants currently work and may be communicating more on a daily basis. Also, P2 and P5 were the youngest of the four participants. For the untreated stimuli, P4 was the only participant who did not maintain treatment effects one month after treatment for production of thematic units. At the one-month follow-up his production of thematic units fell below baseline for the untreated stimuli. P2 and P5, again, continued to increase their production from the immediate follow-up to the one-month follow-up.

Maintenance of decreasing global coherence errors varied across participants for treated and untreated stimuli. At the one-month follow-up P4 decreased repetitions to zero for treated stimuli, but all other participants exceeded baseline levels. P4 kept his production of repetitions (from the immediate follow-up) at zero for the untreated stimuli, and maintained the treatment effects. For production of fillers, P1 maintained productions below baseline for the untreated stimuli. He demonstrated continued decrease in production from the initial and one-month follow-up. P4's production for the treated stimuli at the one-month follow-up was also below baseline level. At the immediate follow-up P5's filler production exceeded baseline levels for treated and untreated stimuli; however, after one month, the production for both stimuli were less than baseline levels. For production of incongruent utterances, P2 maintained treatment effects for treated and untreated stimuli. He demonstrated a continuous decline in production of incongruent utterances from the immediate to one-month follow-up. P5 maintained treatment effects for the treated stimuli. P1 maintained treatment effects for decreasing tangential utterance for treated and untreated stimuli. P2 maintained effects for treated stimuli and remained at zero productions for the untreated stimuli through the baseline and maintenance phase. For production of tangential utterances, P4 consistently produced zero utterances throughout the baseline and maintenance phases for the treated stimuli and maintained treatment effects for the untreated stimuli. P5 maintained effects for reducing tangential utterances for the treated stimuli. Overall measures of global coherence were maintained for all participants for treated and untreated stimuli. P1 demonstrated continued decrease in production of global coherence errors from immediate follow-up to one-month follow-up for the untreated stimuli. P2 demonstrated a continued decrease for both stimuli. P4's immediate follow-up for the treated stimuli revealed global coherence error productions that were the same as baseline, however, they decreased one month after treatment. P5's immediate results exceeded baseline, however at the one month follow-up, the mean dropped below baseline for the untreated stimuli.

Maintenance of narrative productivity measures also varied. All participants maintained treatment effects for production of units for treated and untreated stimuli. P5 demonstrated continuous improvement by producing more units at the one-month follow-up compared to the immediate follow-up. This was demonstrated for treated and untreated stimuli. P1 and P4 followed the same pattern for untreated stimuli only. For the treated and untreated stimuli, P5 was the only participant whose speech rate at the one-month follow-up fell below baseline. All other participants maintained effects. One month after treatment, all participants continued to produce higher number of correct words pertaining to treated stimuli. P1 and P5 demonstrated an increase from the immediate follow-up to the one-month follow-up. For the untreated stimuli, P2's production remained below baseline. P1 and P5 continued to increase production of correct words for untreated stimuli as well.

Summary

The results indicate that the discourse processing treatment was successful in improving performance on measures of micro- and macro- linguistics processes in PWA. As demonstrated in previous studies, (e.g., Osiejuk, 1991; Penn et al., 1997; Kemper & Goral, 2011) treating at the discourse level improves communication skills in PWA. Though maintenance one month post-treatment was inconsistent for the measures of micro- and macro- linguistic processes; it appears that the discourse processing treatment has the potential to result in durable treatment effects in PWA.

When analyzing production of thematic units for treated and untreated stimuli, improvement was observed for all participants but varied across stimuli. All participants demonstrated some level of improvement for both stimuli immediately following treatment. Only one participant (P4) failed to maintain treatment effects after the one-month follow-up. This was observed on the untreated stimuli. All other participants maintained improvements after one month for both sets of stimuli. Additional analysis of narrative productivity and narrative coherence revealed overall improvements post-treatment, but the improvements were inconsistently maintained. Improvements were noted on treated stimuli, untreated stimuli, and generalization probes.

Improvements primarily occurred due to the intensity of the treatment and the emphasis on referencing all components depicted in the picture during story-telling. Using a story-telling task challenged the participant to organize their thoughts, sequence events, identify characters, identify actions, discuss emotions, and expand their vocabulary. The sequential picture stimuli served as a visual cue and the comprehension questions helped “set the stage” for what elements were needed in order to produce a complete story. Throughout the treatment phase, participants were encouraged to confront their word finding difficulties. Ultimately, this led to many instances of self-correcting and self-monitoring. Participants self-corrected on the untreated stimuli as well. The basic required components that are needed to tell a story include setting, initiating event, direct consequences, and resolution. By training sequencing events, highlighting emotions, introducing characters, discussing events, etc., participants were able to apply the processes acquired to the untrained stimuli.

Discourse Processing Treatment

Number of thematic units produced was calculated to determine if the discourse processing treatment improved discourse production abilities in four adults with aphasia. Thematic unit measures and the measures of narrative productivity and narrative coherence yielded significant information regarding the participants' discourse production. Following treatment all participants demonstrated some level of improvement on measures of narrative productivity and narrative coherence. No evidence exists in the current literature as to what magnitude of change constitutes significant change on the CETI. Within the current study, participant and proxy reports suggested improved communication abilities in everyday living situations. When considering participants' improvements on the linguistic analyses, their perception, and their family member's perception of improved communication abilities according to the CETI, findings from the current study suggest that the discourse processing treatment resulted in meaningful changes in participants' discourse abilities. The treatment was ineffective in producing significant change on the WAB-R, which was expected and similar to findings in previous treatment studies (e.g., Marini et al., 2011; Penn et al., 1997).

Similar to Marini et al., (2011) participants in the current study demonstrated improved discourse ability observed through improvements on micro- and macro- linguistic measures post-discourse processing treatment. Penn, Jones, and Joffe (1997) applied a hierarchical discourse treatment approach to improve discourse ability in adults with mild aphasia and found that all participants demonstrated a higher level of functioning on all tasks. The four participants in the current study also demonstrated higher levels of functioning (e.g., increased production of thematic units, increased production of narrative productivity measures) following treatment. The current study used 12 sequential picture stimuli whereas Penn et al., (1997), utilized five different tasks including pictures, poems, and texts. Osiejuk (1991) conducted a case study where the participant attended 30 therapy sessions, which more than doubled the amount of treatment sessions in the current study. Similar to the current study, Osiejuk (1991) elicited narrative and procedural discourses. An additional step, which was not included in the current study, was to test memory recall by measuring how well the participant would retell a story with no visual or verbal models. Osiejuk (1991) found that post-treatment, the participant increased the amount and complexity of discourse produced. In the current study, the main measure of change was thematic units which included main actions and elements needed to tell a complete story. Osiejuk (1990) found that following treatment the participant included nearly complete discourse productions that included basic elements for the summary. The same results were seen in the current study by analyzing production of thematic units. Following treatment, participants increased the number of thematic units and produced stories that were more complex and included more elements and actions. The current study extends the notion that positive changes in discourse can result from discourse treatment.

Andreeta et al., (2012) concluded that in individuals with aphasia, difficulties may result from a “bottom-up process”, indicating that lexical retrieval is the driving force as opposed to a “top-down process” that would concern the conceptualization of the story. The current study was representative of a “top-down” treatment. The conceptual components of each picture stimuli were addressed in the comprehension questions that were administered prior to treatment of each stimulus. The clinicians assured that participants demonstrated an understanding of the concepts portrayed in the stories by correctly answering the comprehension questions. As such, participants' incomplete story-tellings were likely a result of difficulties with lexical retrieval; a "bottom-up process" as Andreeta (2012) indicated.

Multi-Level Analysis

Various studies (e.g., Lafeuil & Le Dorze, 1997; Prins, Snow, & Wagenarr, 1978; Shewan, 1988) revealed that improvements that are not depicted through standardized assessments can be observed in PWA following treatment. The current study applied a multi-level analysis that jointly focused on functional aspects of language processing and structural linguistics. As demonstrated in the current study, applying this method is beneficial for identifying strengths and weaknesses in PWA's communication abilities. Similar to previous findings (e.g., Andreetta et al., 2012; Marini et al., 2011; Sherratt, 2007) the multi-level analysis applied to the current study revealed a more productive investigation of discourse production for PWA. Further, as expected, the multi-level analyses were more sensitive to changes resulting from the discourse processing treatment compared to the standardized measure, the WAB-R, and supported by participant and proxy reported improvements per the CETI results.

Anecdotal Information

Reports from participants and spouses may provide additional insight into why results varied across participants. Motivation may have influenced participants' performance. Though P4 participated in each session and chose to continue with the study, he expressed his desire for the treatment to be finished. He improved during treatment; however, performance on some measures fell below baseline levels at the one-month follow-up session. His spouse reported that she believed the study made her husband more aware of how he was talking.

Throughout the study, P1 verbalized how much he enjoyed the story telling. When comparing outcomes to the other participants, it was no surprise that P1's results for the amount of units produced at the end of treatment were higher than other participants. He tended to speak for a much longer time and added depth and detail to his story. However, this likely contributed to his increased tangential utterance results that were higher than other participants.

P5 was highly motivated throughout the study. Although she demonstrated instances of frustration, she expressed multiple times that she wanted to improve. Based on the analysis of treated stimuli, P5 was the only participant to demonstrate a large treatment effect size (22.4). Throughout the treatment and maintenance phase P5 notably put forth effort, she took her time, and focused on her word finding difficulties. P5 was very self-aware and when she made a mistake, she would often try to fix it instead of passing over it or choosing another word. This may be attributable to P5's minimally changing or declining speech rate. P5 was hopeful that the treatment would help her with her daily life and engaging in conversations.

Limitations and Suggestions for Future Research

There were several limitations to the study. Because this was an intensive study, participants were expected to attend three to four sessions a week which proved to be demanding for the participants. The intensity of the study seemed to negatively affect some of the participant's attitudes towards the treatment. The treatment did result in demonstrated gains and some maintenance of treatment effects; however, future investigations with the discourse processing treatment should include different delivery methods for comparisons. Perhaps decreasing the amounts of treatment sessions per week but adding additional weeks to the treatment phase would be beneficial for producing more durable treatment effects.

Treatment stimuli included eight sequential pictures randomly selected so that four were used in each treatment session. Though the same stimuli were not used in each session, participants became familiar with the picture sequences. Future studies should include more stimuli for several reasons. Additional stimuli would provide more opportunities to produce discourse and would reduce potential learning effects with the stimuli.

Another limitation was the number of study participants. The purpose of this study was to pilot the treatment in a Phase I treatment study. Future investigations should include more participants with aphasia and different types of aphasia. Further, longer post-treatment follow-up trials (e.g., 3-month and 6-month) should be included to document long-term maintenance of treatment effects. Step 1 of the treatment included participants answering comprehension questions pertaining to the stimulus prior to telling the story depicted. Participants became very familiar with the questions and the answers to them. Future studies should consider reducing the number of treatment sessions that include Step 1 or add more questions and randomly select questions to ask in Step 1 of the treatment.

An additional limitation was the limited focus on cognitive aspects of discourse. If additional studies incorporated more focus on cognitive components and included a stronger cognitive component to the treatment perhaps the measurements for global coherence would have demonstrated more improvement and maintained treatment effects. A way to incorporate cognitive treatment would have been to include additional or varying comprehension questions or implement a home program. In addition, including a memory recall component similar to Osiejuk (1997) would be beneficial for measuring how well the participant could retell the story without a visual or verbal model.

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TABLES AND FIGURES

Table 2.1. Participant's Demographic Information

Participant	Age	Race	Gender	Years of Education	Months Post-Onset	Initial WAB-R AQ
P1	86	White	Male	21	24	87.2
P2	67	White	Male	16	240	75.9
P4	68	White	Male	12	72	81.4
P5	62	White	Female	17	24	82.5

Table 2.2. The discourse processing treatment steps

Step	Activity	Activity Description
Step 1	View stimulus with comprehension questions	PWA views the sequential picture and clinician probes for level of understanding by asking specific comprehension questions that are paired with the picture.
Step 2	Tell Story	While using the story guide, the PWA will tell a story.
Step 3	Clinician reviews story and elaborates	Using the story guide, the clinician retells the story while elaborating on or filling in missing details.
Step 4	PWA retells story	While viewing the stimuli, by not the story guide, the PWA retells the story.

Figure 2.1. Story guide used during Steps 2 and 3 of the discourse processing treatment

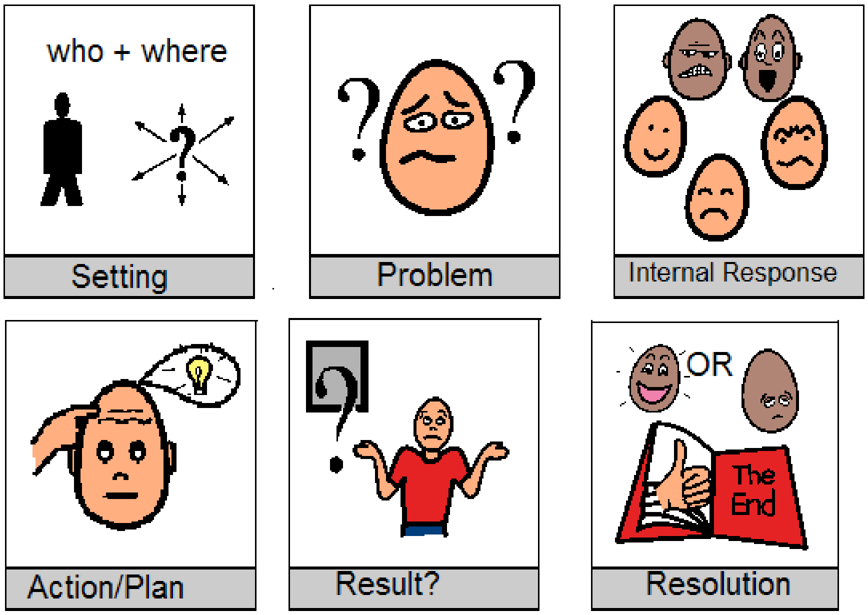


Table 3.1. Percentage of Total Number of Correct Thematic Units Produced for Trained and Untrained Stimuli and Effect Sizes.

Participant	Stimuli	BL	F1	F2	Effect Size
P1	T	26.3	52.6	33.3	5.1
	U	15.1	32.5	19.7	6.7
P2	T	37.3	52.6	53.7	0.7
	U	36.5	42.8	47.7	0.5
P4	T	15.2	40.1	20.3	0.9
	U	15.2	24.0	10.1	0.4
P5	T	33.0	54.1	69.0	22.4
	U	36.7	41.1	77.9	3.6

Note. T= trained stimuli (8) U= untrained stimuli (4), BL= mean of baseline trials, F1=immediate follow-up, F2= one-month follow-up. Effect size interpretation: 2.6= small (S); 3.9= medium (M); 5.8= large (L).

Table 3.2. Mean Production of Global Coherence Errors: Repetitions, Fillers, Incongruent Utterances, and Tangential Utterances Produced for Treated and Untreated Stimuli

	Stimuli	Repetitions			Fillers			Incongruent Utterances			Tangential Utterances		
		BL	F1	F2	BL	F1	F2	BL	F1	F2	BL	F1	F2
P1	T	0.1	0.4	2.1	1.3	0.1	2.6	1.5	3.0	2.0	0.8	0.2	0.6
	U	0.0	0.5	0.5	1.7	1.2	1.0	2.2	3.2	3.2	0.8	0.0	0.0
P2	T	0.3	0.6	1.5	1.1	1.5	1.8	1.2	1.1	0.3	0.4	0.0	0.1
	U	0.2	0.5	0.2	0.3	1.0	0.7	0.1	0.7	0.0	0.0	0.0	0.0
P4	T	0.1	0.7	0.0	2.1	0.3	1.3	0.6	1.1	0.6	0.0	0.0	0.0
	U	0.1	0.0	0.0	1.1	0.7	1.2	1.1	1.7	1.2	0.1	0.0	0.0
P5	T	0.2	1.2	1.7	0.4	0.8	0.2	1.8	0.8	0.8	0.1	0.0	0.0
	U	0.0	1.5	1.0	1.1	1.5	0.0	1.1	2.2	2.0	0.0	0.2	0.2

Figure 3.1. Mean of Total Global Coherence Errors Produced for Treated and Untreated Stimuli

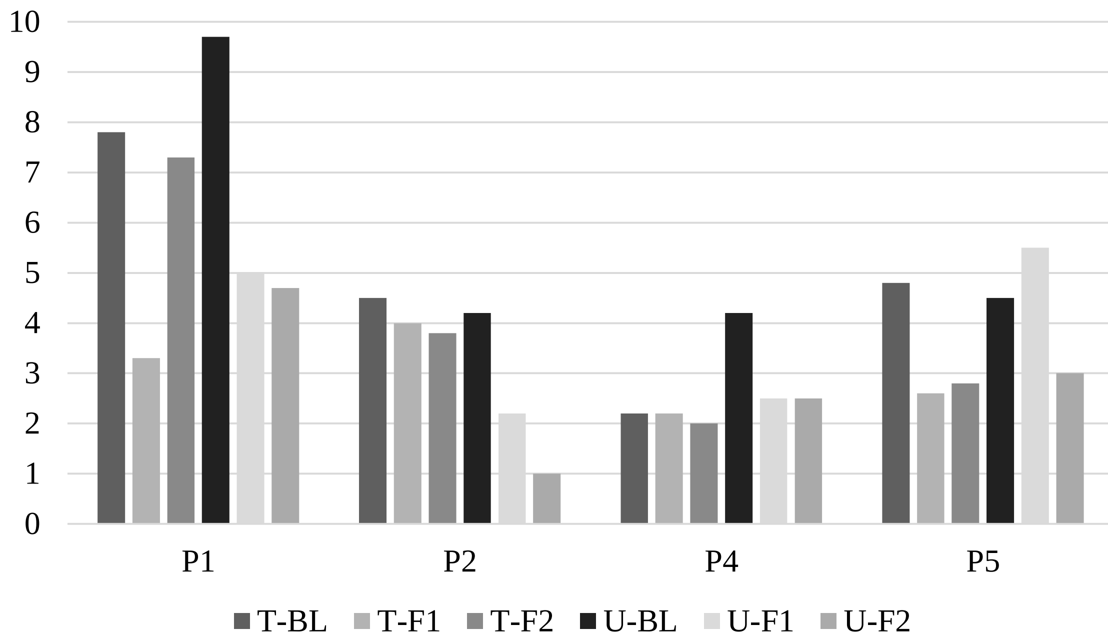


Table 3.3. Mean Production of Narrative Productivity for Treated and Untreated Stimuli

	Stimuli	Units			Speech Rate (wpm)			Correct Words		
		BL	F1	F2	BL	F1	F2	BL	F1	F2
P1	T	78.8	131.3	129.8	44.5	62.7	48.0	35.4	60.8	78.8
	U	65.3	120.0	163.0	34.8	64.3	54.2	29.2	66.5	95.0
P2	T	86.1	127.8	124.8	48.8	72.4	63.3	51.5	85.0	71.8
	U	21.5	79.2	78.2	50.4	58.5	57.5	58.3	53.2	47.2
P4	T	48.5	89.8	81.5	55.5	77.8	68.0	25.5	60.6	50.0
	U	36.0	59.7	60.5	49.7	38.8	58.0	18.7	38.7	30.7
P5	T	91.6	150.2	174.6	64.7	69.0	56.8	41.4	90.8	95.0
	U	80.3	152.0	165.5	69.1	55.2	65.6	40.7	83.2	95.2

Note. Units and Correct Words are presented in percentages.

Table 3.4. Comparison of *Western Aphasia Battery-Revised* (WAB-R) Results

Participant	Initial WAB-R AQ	Follow-Up WAB-R AQ	Change
P1	87.2	88.9	1.7 points
P2	75.9	78.2	2.3 points
P4	81.4	77.6	-3.8 points
P5	82.5	82.9	0.4 points

Figure 3.2. Participant CETI Results

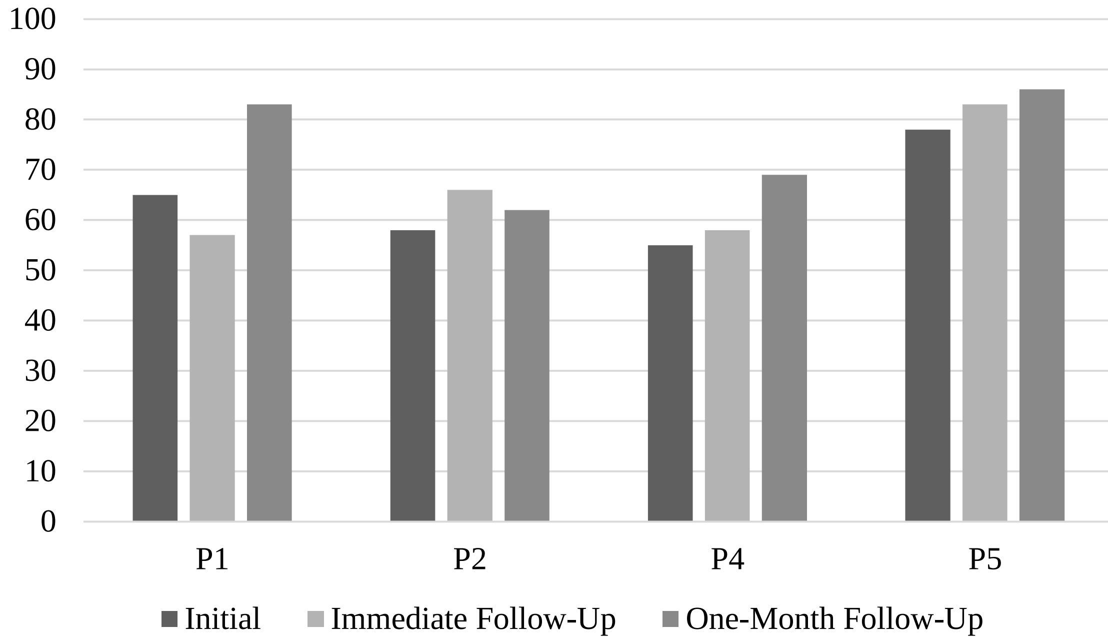
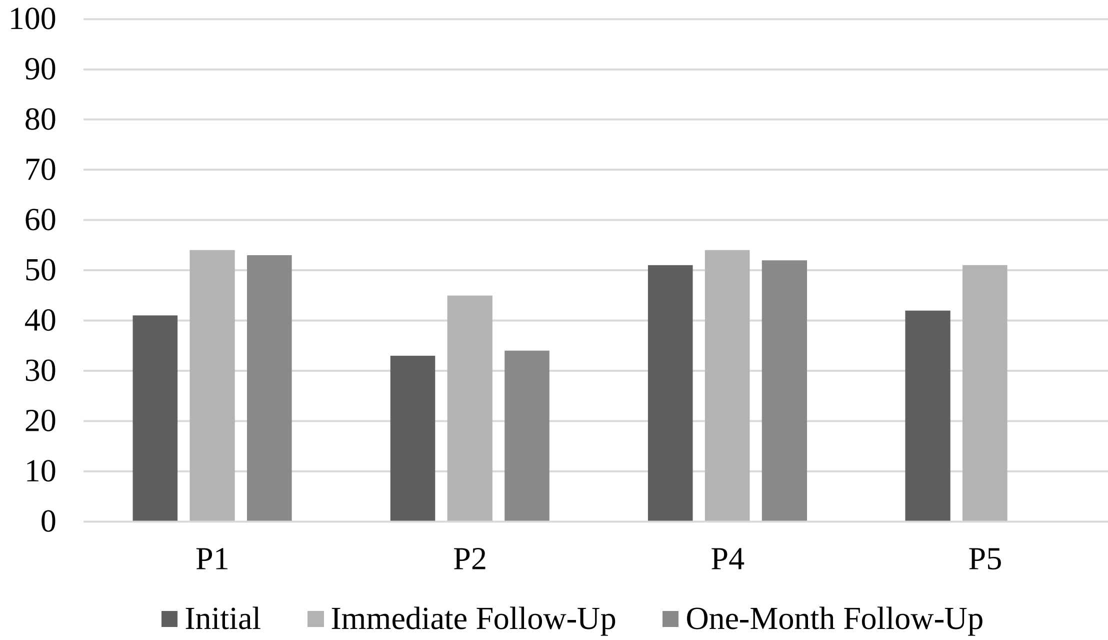


Figure 3.3. Family Member CETI Results



Note. One-month follow-up unavailable for P5

APPENDIX A: IRB APPROVAL LETTER

EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
4N-70 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office 252-744-2914 · Fax 252-744-2284 · www.ecu.edu/irb

Notification of Initial Approval: Expedited

From: Biomedical IRB
To: Heather Wright
CC:
Date: 6/24/2014
Re: UMCIRB 14-000803
Discourse Treatment for individuals with Brain Injury

I am pleased to inform you that your Expedited Application was approved. Approval of the study and any consent form(s) is for the period of 6/23/2014 to 6/22/2015. The research study is eligible for review under expedited category #5,6,7. The Chairperson (or designee) deemed this study no more than minimal risk.

Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The Investigator must adhere to all reporting requirements for this study.

Approved consent documents with the IRB approval date stamped on the document should be used to consent participants (consent documents with the IRB approval date stamp are found under the Documents tab in the study workspace).

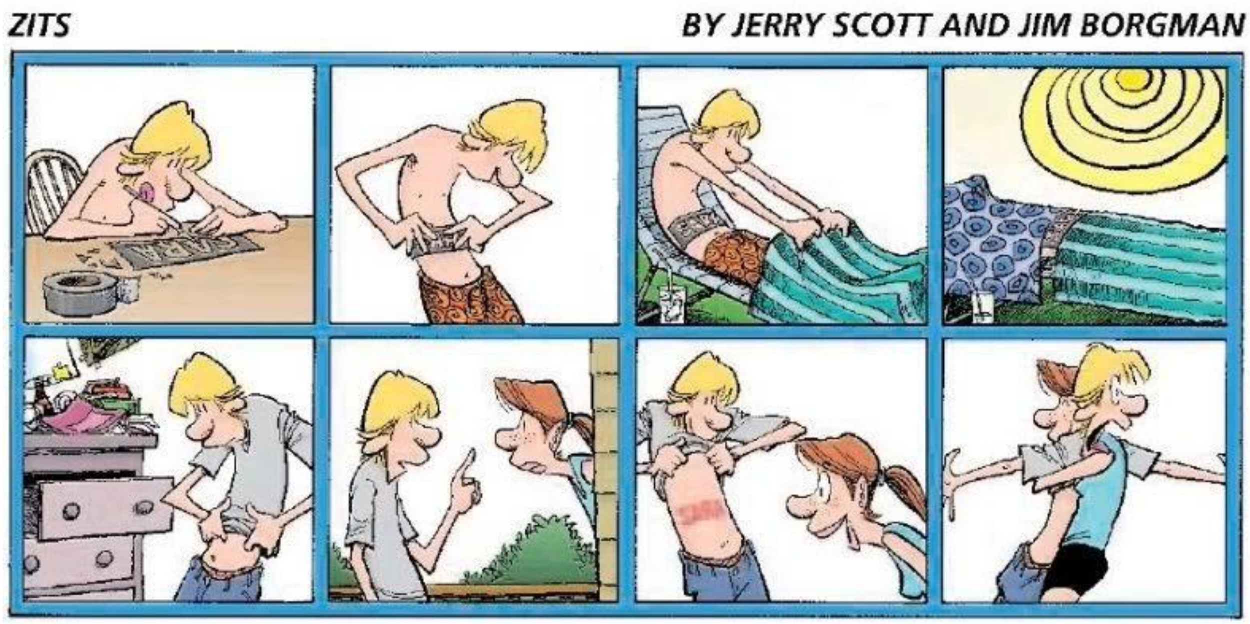
The approval includes the following items:

Name	Description
COmmunity Resources_Depr.doc	Additional Items
consent form_Obj2.doc	Consent Forms
Depression Scale Scripts.doc	Additional Items
GDS	Surveys and Questionnaires
HIPAA-Authorization.docx	HIPAA Authorization
med & educ info.doc	Surveys and Questionnaires
Protocol	Study Protocol or Grant Application
WAB	Standardized/Non-Standardized Instruments/Measures
WMS.pdf	Standardized/Non-Standardized Instruments/Measures

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

APPENDIX B: EXAMPLE STIMULI

B1. *Sequential picture stimulus* (8 pictures)



B2. *Comprehension Questions*

1. What is the guy carving?
2. Who are the characters in the scene?
3. How does he get her name on him?
4. What does the guy do outside?
5. How does the girl react?
6. What is his reaction at the end?

B3. *Thematic Units (24 total)*

Essential Elements	**Detail Elements**	**Essential Actions**	**Detail Actions**
guy	Shirt	carving her name	goes to sleep
girl/girlfriend	House	covers himself up	lifts up his shirt
tattoo	pool chair	puts it/stencil around his stomach	shows her what is written/tattoo
stomach	Drink	goes to lay down	she is happy/excited
Cara/Sara	Tape	name tattooed on his body	
sun	cardboard paper	she hugs him	
	suntan		
	blanket/towel		