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# Examining the Effectiveness of Intensive Language Action Therapy in Individuals with Nonfluent Aphasia

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Examining the Effectiveness of Intensive Language Action Therapy

in Individuals with Nonfluent Aphasia

by

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## Dedication

This dissertation is dedicated to my friends and family who have inspired and supported me throughout this process. I would first like to thank Dr. Chick LaPointe, whose mentorship and enthusiasm steered my pursuits into aphasia research. I would like to thank Natalie Douglas and Stephanie Karidas. Natalie, who as a good friend, was always able to remind me of the 'big picture' while giving her best suggestions. Many thanks to Stephanie for always offering encouragement, research assistance, collaboration, and laughter! Thanks to Lini Nakano for inspiring me with her enthusiasm for helping and learning from individuals with aphasia. I would also like to give thanks to my dear friend, Jihan Ali, for the hours of time she committed to providing me with essential help through yet another degree! Finally, many thanks go to my dear friend Khalyn Wiggins for appreciating the countless number of coffee spoons.

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## Table of Contents

## List of Tables

## List of Figures

**Abstract**

*Background:* Individuals with nonfluent aphasia may have significant difficulties with functional spoken communication tasks in their daily life. Aphasia treatment held in a group setting may provide an enriched communicative context wherein the requirements of spoken language are similar to those within functional day-to-day communicative situations. Thus engaging in a spoken language activity in a group setting may directly target generalization of trained skills to those required in real-life, social communication situations. The present study is concerned with an aphasia group treatment that requires focused practice of spoken language during a social-functional communication task. Intensive Language Action Therapy (ILAT) has demonstrated positive communication outcomes in some individuals with chronic aphasia. However, it remains to be seen which clinical measures best index outcomes for ILAT. The purpose of the current study was to determine the effectiveness of ILAT in individuals with nonfluent aphasia by exploring multiple, potential ILAT outcomes. The outcomes included change in performance on assessments of directly trained spoken social-functional communication abilities (proximal outcomes), untrained social-functional communication abilities and language abilities (primary outcomes), and cognitive-communication abilities (secondary outcome). Additionally, the project aimed to explore the participants' perceptions of ILAT (secondary outcome).

*Methods and Procedures:* ILAT was implemented with four individuals with nonfluent aphasia, using a single-subject multiple baseline design. The treatment was conducted daily for 10 consecutive week days, totaling 25 hours of treatment. Treatment probes (i.e., using trained and untrained picture cards and an unrelated control-task of nonword repetition), a pre/post assessment battery, and a post-treatment survey/interview were administered to assess performance on the treatment task, generalization to other potential ILAT outcomes, and participants' perceptions.

*Outcomes & Results:* Increased accuracy was observed for trained and untrained items. However, two of the four participants were not able to reach a criteria determined a priori for treatment performance. Performance on items that were untrained resulted in some improvements in performance for all participants. Three of the four participants demonstrated small effect sizes in response to ILAT. One participant who demonstrated a medium effect size in response to ILAT also demonstrated a clinical significant change in discourse abilities, a measure of spoken social-functional communication abilities. All participants demonstrated improvements on at least one primary outcomes measure. Two participants, however, demonstrated a decline. All participants, however, perceived a positive experience with ILAT on a qualitative posttreatment survey/interview.

*Conclusions:* Patterns were found between skills directly trained during ILAT, proximal outcomes, and performance on primary and secondary outcome measures of language, social-functional communication, and cognitive-communication, meant to assess generalization of trained skills to similar or potentially related untrained skills. A substantial amount of change (e.g., at least a medium effect size) on proximal outcome measures may be required in order for improvements to occur in primary and secondary outcome measures. Participants' perceptions of a positive treatment experience associated with the ILAT program further supports the value of the treatment. Future research should aim to further examine the influence of ILAT treatment components and participants' characteristics.

## Chapter One: Introduction

In the United States, on average, someone has a stroke every 40 seconds. One-fifth of strokes result in the language impairment termed aphasia. Approximately one million people in the United States have aphasia (NIDCD, 2008; Roger et al., 2012). Aphasia has multifaceted psychosocial consequences, including depression, social isolation, and changes in family roles (Sarno, 1998).

The consequences of aphasia may be best demonstrated by using the World Health Organization (WHO) International Classification Framework (ICF) (2001) , which indexes impairments in body function (the language impairment—language reception, i.e., reading and listening, and language expression, i.e., writing and speaking), and activity limitations and participation restrictions, such as decreased participation in social activities and changes in family roles. In terms of the language impairment, at the core of the language deficits associated with aphasia is the presence of difficulties retrieving words during spoken language production, varying in severity from minimal trouble producing informative words during conversational speech, to severe deficits in producing words of choice during any situation (Helm-Estabrooks & Albert, 2004). The impairments in spoken language production associated with aphasia often lead to social-functional communication difficulties or problems with the use of language in daily communicative and social activities (Simmons-Mackie & Damico, 2007; Simmons-Mackie, Elman, Holland, & Damico, 2007). For example, individuals with aphasia often have difficulty using conversation in order to engage in social life (Simmons-Mackie & Kagan, 2007; WHO, 2001). The present study is concerned with intervention aimed at improving spoken language production in aphasia and the impact of those deficits on social-functional communication abilities.

Meta-analyses have supported the value of both individual (one-on-one) and group (more than one individual receiving treatment simultaneously) treatment for language abilities (Robey, 1994; 1998). Aphasia group treatment, however, has been suggested to provide an enriched communicative context wherein the requirements of spoken language are similar to those within functional day-to-day social communicative situations or social-functional communication (Pulvermuller & Berthier, 2008; Wilcox & Davis, 1977). Thus engaging in a spoken language activity in a group setting may directly target generalization of trained skills to those required in real-life, social-functional communication situations.

One form of aphasia group therapy that focuses on social-functional communication abilities is conversational aphasia group treatment. Conversational aphasia group treatment has been deemed efficacious (Elman & Bernstein-Ellis, 1999). In an oft cited group treatment study, Elman and Bernstein-Ellis (1999) found that aphasia group treatment requiring structured conversation between group members demonstrated significantly higher scores on outcome measures of language abilities and social-functional communication, compared to unguided socialization.

Aphasia group treatment typically targets social-functional abilities and outcomes (Kearns & Elman, 2008) using any modality or compensatory strategy. For example, van der Gaag and colleagues (2005) listed general goals of their group therapy to be conversation and communication skills, discussion, and self-advocacy. Another example of an aphasia group therapy targeting social-functional communication abilities and outcomes is Marshall's (1993) problem-focused group treatment. The author stated that the focus of the treatment was on a reduction of the psychosocial impact of aphasia, such as changes in ability to complete occupational and leisure activities, and improving integration within society though problem-solving discussions and group conversation. In a survey of aphasia group therapy practices with a sample of 91 speech-language pathologists within the Veteran Administrative Medical Centers across 45 states, Kearns and Simmons (1985) found that approximately 45% of the participants listed socialization as a primary treatment goal of group aphasia therapy. Participants also reported that approximately one-third of typical sessions targeted "general topic oriented discussion." It appears that social-functional communication goals and outcomes are common to aphasia group therapy.

Aphasia group treatments that target social-functional communication may improve social-functional communication abilities, or may improve language impairments, but these conclusions are limited by the choice of measures used. First, social-functional communication treatments may not produce improvements in measures of language impairments, such as standardized language performances (Aten, Calguiri, & Holland, 1982). For example, in a study by Aten, Calguiri, & Holland (1982) seven individuals with chronic nonfluent aphasia participated in an aphasia group therapy requiring multimodal social-functional communication skills during role-play activities of daily communicative situations, such as shopping in a grocery store and giving directions. Participants demonstrated improvements in social-functional communication abilities, as measured by the Communicative Abilities in Daily Living (CADL; Holland, 1980), but not on language abilities, as measured by the Shortened Porch Index of Communicative Abilities (SPICA; Disimoni, Keith, & Darley, 1980). Thus Aten et al. (1982) found that an aphasia group treatment that focused on social-functional communication abilities did not produce improvements in measures of language impairments, such as standardized language assessments.

Conversely, improvements in language abilities were found in response to a structured conversational aphasia group treatment, such as one focused on initiation of communicative attempts and exchange of information (Elman & Bernstein-Ellis, 1999). In a study by Elman & Bernstein-Ellis (1999) improvements were found in social-functional communication abilities and language abilities in response to an aphasia group therapy, as measured by SPICA (Disimoni, Keith, & Darley, 1980) and the Western Aphasia Battery (WAB; Kertesz, 1982), i.e., two measures of overall language impairment, and the CADL (Holland, 1980), i.e., an assessment of social-functional communication.

In a meta-analysis of the effectiveness of aphasia group therapy, Robey (1998) concluded that although the goals of aphasia group therapy focused primarily on social-functional communication, the assessment of change in overall language impairments has been used most often to assess response to aphasia group therapy (in studies that met inclusion criteria). Clinical assessments used to describe response to aphasia group treatments may not have provided the best index of associated outcomes, such as changes in social-functional communication abilities.

Intensive Language Action Therapy (ILAT; Pulvermuller, Neininger, Elber, Mohr, Rockstroh, Koebbel, & Taub, 2001) is an aphasia group therapy that has shown some effectiveness (Cherney et al., 2008; 2010). ILAT produces outcomes in both social-functional communication and spoken language production measures simultaneously, in a short course of intensive therapy. Several studies have examined clinical outcomes in response to ILAT with results providing at least 'modest evidence for the positive effects of ILAT,' typically in relation to improvements on outcome measures of the language impairment (Faroqi-Shah & Virion, 2009; Kurland et al., 2012; Maher et al., 2006; Meinzer et al., 2005; Pulvermuller et al., 2001). Previous ILAT research provided limited focus on the assessment of the social-functional communication abilities that are a natural component of the ILAT therapy approach (Cherney et al., 2008). The results of these studies are reviewed with a focus on the outcomes measured. First, however, the neuroscientific principles and social-functional communication therapy approach that form that basis of ILAT intervention have been described.

## Development of Intensive Language Action Therapy (ILAT)

**Social-functional therapy approach using speech acts.** Intensive Language Action Therapy (ILAT) was based on a social-functional communication therapy approach using speech acts (Aten, Caligiuri, & Holland, 1982; Davis & Wilcox, 1985; Pulvermuller & Roth, 1991; Searle, 1969). A social-functional communication therapy approach, as mentioned previously, primarily targets language-use, or communication at the ICF level of activity limitation and participation restrictions (WHO, 2001). Speech acts, introduced by Searle (1969), include specific types of utterances, words or sentences that are required to participate in daily social conversations, called propositions. Illocutionary force is the term used by Searle (1969) to describe the communicative intent of a proposition by a communicator, such as an intent to thank, greet, agree, advise, command, congratulate, promise, warn, question, complain, or request (Wilcox & Davis, 1977; Searle, 1969). The concept of speech acts requires a combination of both the proposition and illocutionary force. Thus an aphasia therapy targeting speech acts targets both requirements in spoken language production and social-functional communication or language-use (Pulvermuller & Roth, 1991), which are necessary to complete everyday communicative situations (Aten, Caligiuri, & Holland, 1982; Wilcox & Davis, 1977; Pulvermuller & Roth, 1991; Searle, 1969).

**Behavioral relevance.** The ILAT principle of behavioral relevance states that "it is advantageous to practice language in relevant action contexts" (Pulvermuller & Berthier, 2008, p. 569). By "action" Pulvermuller and Berthier (2008) are referring to the speech acts described by Searle (1969). The principle activity within ILAT involves a language game where the "action structure of this language game is that of a typical request communication" (Pulvermüller & Berthier, 2008, p. 577). Although, there are many speech acts that may be potential targets during ILAT, the primary speech act that has been targeted during previous ILAT research (and within the present study) is a verbal request.

Additionally, based on neuroscience this principle of behavioral relevance also refers to two separate areas or regions of the brain having a functional bond (Pulvermuller & Berthier, 2008). The relationship between the two related neural regions is thought to strengthen by intensive practice targeting functionally relevant tasks to both areas (Robertson & Murre, 1999). Pulvermuller & Berthier (2008) proposed that the relationship between the motor cortex and the areas of the brain contributing to speech and language is strengthened during ILAT. Further, Pulvermuller and Berthier (2008) suggested that an enriched communication context may further support recovery in speech and language. In ILAT the enriched and relevant action context is that of a group setting using speech acts, where individuals are required to communicate using spoken language production with other group members during a social-functional communication therapy.

**Focusing.** The focus on spoken language production during ILAT was originally based on a group of therapies called, "constraint-induced movement therapy" (Pulvermuller et al., 2001). Research on these therapies found focused training, on a neurologically-impaired area, to produce greater clinical improvements, compared to compensatory use of a neurologically-unimpaired area, suggesting training-induced brain re-organization (Taub, Uswatte, & Elbert, 2002). Constraint-induced movement therapy was first examined in animal studies. Monkeys that were given surgically-induced somatosensory damage, affecting one limb, spontaneously utilized the unimpaired limb as a compensatory strategy. However, after constraining the unimpaired limb and providing training, monkeys were able to recover functioning of the impaired limb (Taub et al., 2002).

The findings from the animal research led to human rehabilitation research, where researchers examined changes in limb functioning in chronic (i.e., 6+ months post-onset) stroke patients with impaired upper extremities (Taub et al., 2002). By reinforcing the repetitive use of impaired limbs, shaping the task requirements (i.e., increasing task difficulty with individual improvement), and constraining unaffected limbs with a sling, improvements in the functioning of the affected limb were found (Taub, Uswatte, & Pidikiti, 1999). The training was focused on directly improving the impaired behavior and capitalizing on the adaptive ability of the brain at the neurological level (plasticity) (Kleim & Jones, 2008). Similar findings have been continuously documented in over 20 years of research with additional neuroimaging studies, indicating reorganization of motor-neural networks and supporting practice focused on restorative gains in impaired limb functioning in place of compensatory-focused rehabilitation (Taub et al., 2002).

The results obtained in studies of constraint-induced movement therapy were considered in relation to speech-language rehabilitation in individuals with stroke-induced chronic aphasia when developing ILAT (Pulvermuller et al., 2001). Individuals with aphasia may demonstrate severe impairments in their speech and language system, which may only allow the spoken language production of a few words in severe cases, directly caused by the stroke (Pulvermuller

& Berthier, 2008). Conversely, Pulvermuller & Berthier (2008) suggested that "patients with some remaining but imperfect language skills may actively retreat to simplistic utterances or even avoid verbal communication, replacing speaking and writing by gestures and pointing" (Pulvermuller & Berthier et al., 2008, p. 570). Therefore, ILAT researchers proposed the focusing principle that "it is advantageous to focus patients on their remaining language abilities; especially on those they avoid using" (Pulvermuller & Berthier, 2008, p. 571). During ILAT, participants are required to use spoken language production in order to communicate a desired message.

**Shaping.** The spoken language requirements during ILAT are matched to challenge each participant's individual abilities. Shaping refers to "carefully controlled steps toward closer and closer approximations of the criterion behavior" (Holland, 1970, p. 378). In some ILAT research this shaping principle is described as part of the focusing principle because the requirements in speech production can be shaped by the researcher, requiring the use of speech production at an achievable, challenging level (Pulvermuller & Berthier, 2008). Three components, i.e., the stimuli, game rules/requirements, and reinforcement contingencies/cueing, are considered to be shaped to the communicative abilities of each individual during ILAT (Pulvermuller & Berthier, 2008). The stimuli are shaped to participants' level of functioning. For example, picture cards of everyday items, that have been found to be easier to produce for individuals with aphasia, may be used initially. Later, after therapeutic gains, stimuli may be increased to include words that are less frequent in language (Pulvermüller & Berthier, 2008). The rules of the game, including the speech productions and responses by the participants, are adjusted throughout the treatment program, shaping responses into successively better approximations, e.g., from word-level to sentence-level to including descriptor words (Cherney, Patterson, Raymer, Frymark, &

Schooling, 2008). Additionally, reinforcement contingencies or feedback provided by the clinician is individually adjusted by the therapist to each participant's therapeutic needs, e.g., cueing misspoken words using semantic associations that are personal to the individual.

**Intensity.** The intensity of a particular treatment regimen is a measure of the amount of treatment (e.g., total number of sessions) and how often a treatment is provided (e.g., X days/week) (Raymer et al., 2008). Intensity has been shown to impact treatment results. A meta-analysis by Robey (1998) concluded that greater treatment effects were found for aphasia treatments delivered for at least two hours per week. In a study by Hinckley & Craig (1998), aphasia patients exhibited increased improvements in word retrieval skills when receiving treatment of greater than 20 hours per week (i.e., when compared to results from treatment for three hours per week). Currently, there is no known dosage for aphasia treatments or set number of treatment hours or sessions/week that qualifies an aphasia treatment as being intensive. However, based on previous aphasia research, ILAT is conducted in an intensive format, including 24-30 total hours of treatment in 4-5 sessions/week within two workweeks.

In summary, aphasia group therapy provides a means for directly targeting communication required during daily social life. ILAT is one aphasia treatment that is administered in a group setting and thus has the potential for addressing social-functional communication abilities. ILAT is based on a social-functional communication approach using speech acts, and combined with four neuroscientific principles (i.e., behavioral relevance, focusing, shaping, and intensity). As discussed below, previous studies support that the approach to intervention inherent in ILAT leads to positive treatment outcomes, primarily related to language abilities. There remains a need to expand the outcomes assessed in ILAT studies.

**ILAT Treatment Outcomes**

In ILAT, a group of individuals with aphasia participate in a social-functional communication task that requires verbal requests for picture cards from other group members. As a result, the *primary* outcomes, or those that are related to the main goals or objectives of ILAT intervention, would include assessments of changes in spoken language production and social-functional communication abilities. In a comprehensive assessment of the effectiveness of any intervention, however, researchers should also consider secondary and proximal, as well as primary outcomes. *Secondary* outcomes refer to outcomes that may not be a primary objective for the treatment, but relate to the primary objective or outcome. For ILAT secondary objectives may include gains in cogntive-communication abilities (i.e., attention, perception, memory, organization, and executive function) (ASHA, 2005) and/or positive perceptions and values relating to the treatment. *Proximal* outcomes refer to the outcomes related to skills directly trained during the treatment (Jobe et al., 2011). For ILAT the proximal outcome would include the social-functional communication task of a verbal request during the treatment. The *primary*, *secondary*, and *proximal* outcomes assessed in previous ILAT research are discussed, respectively, below.

**Primary ILAT outcomes.** Language abilities have been assessed in previous ILAT studies by global outcomes measures of language abilities (e.g., reading, writing, repeating, listening) and by naming assessments, such as naming pictures. The use of social-functional communication assessments, or assessments of the use of language in behaviorally relevant contexts, has been limited in previous ILAT studies. Language assessments and social-functional communication assessments that have been used in previous ILAT research will be discussed next.

***Language assessments.*** Overall language improvements were originally suggested as one primary outcome of ILAT, with social-functional communication abilities being the other (Pulvermuller et al., 2001). The first study to demonstrate improvements in language abilities in response to ILAT was a randomized controlled trial conducted by Pulvermuller and colleagues (2001). The researchers compared ILAT to a conventional speech-language treatment. The number of hours of therapy was the same for both the ILAT and the conventional treatment study (i.e., ~ 30 hours), with ILAT administered in an intensive format (i.e., ~ 3 hours per day for 10 consecutive week days) and the conventional training administered less intensely, over a longer period of time (3-5 weeks). Participants in both treatment groups were heterogeneous in aphasia types and severities, including participants with Broca's, Wernicke's, Conduction, and Transcortical Motor aphasia varying in severity from mild-severe. The conventional speech-language treatment included tasks such as naming, sentence completion, and following directions.

Pulvermuller and colleagues (2001) measured response to ILAT with an overall language assessment that included subtests of both comprehension and expression (i.e., *Aachen Aphasia Test*; Huber et al., 1983), a test solely for language (auditory) comprehension (*Token Test*; DeRenzi & Vignolo, 1962). As a whole, the group receiving ILAT (*n*=10) made statistically significant improvements on these measures. The conventional language treatment group (*n*=7) did not show any statistically significant improvements on any of the outcome measures. The results from this randomized controlled clinical trial led the authors to conclude that ILAT resulted in better outcomes than traditional speech and language treatment. The authors did not provide information regarding individual response to treatment with any of the language measures. Perhaps only some of the participants demonstrated improvements in the language measures.

Another study, by Meinzer, Djundja, Barthel, Elbert, and Rockstroh (2005), provided further evidence for language improvements in response to ILAT. The researchers expanded on the study by Pulvermuller and colleagues (2001), by examining the long-term outcomes of ILAT at six-months post-treatment with a slightly larger sample size. Using a pretest-posttest group design, ILAT ($n$ = 12) was compared to a modified ILAT program ($n$ = 15) that included additional training of written language and everyday communication situations, along with homework activities involving social-functional communication with assistance from relatives (e.g., ordering at a restaurant and recording the activity in a diary). Across the two treatment groups, participants presented with heterogeneous aphasia types, mostly Broca's ($n$ = 11) and Wernicke's ($n$ = 7) aphasia, and severities from mild to severe. Language abilities improved significantly for both groups. The researchers found no between group differences as measured by an overall language assessment (i.e., *Aachen Aphasia Test*). Thus, the researchers concluded that the addition of the tasks within the modified ILAT group did not produce better outcomes, immediately after treatment, than those observed in the typical ILAT group.

Perhaps a more important result than the finding that the additional elements did not enhance ILAT outcomes was the responses of the individual participants to the ILAT intervention. That is, mixed results were found for language outcomes for individual participants, such that four of the 12 participants in the ILAT group and six of the 15 in the modified-ILAT group showed no improvements on any of the posttreatment subtests from the language measure. Improvements made by the remaining eight participants in the ILAT group and the remaining nine from the modified ILAT group, however, remained stable at the six-month follow-up. Although the data at the group level were very encouraging, even after six months, the lack of improvement in all participants highlights the need for assessing individual responsiveness to ILAT intervention.

Maher and colleagues (2006) provided another example of modest improvements in language abilities in response to ILAT. The researchers compared ILAT to another therapy held in an intensive format (24 hours total of treatment in eight days). The comparison treatment did not require spoken language production, as in ILAT, and instead allowed the use of communicative compensatory strategies. The participants in each treatment group were relatively balanced for aphasia types and severities, representing a small heterogeneous sample with *n* = 4 participants in the ILAT group and *n* = 5 in the comparison group. Both groups demonstrated significant improvements on post-treatment language assessments (i.e., *Boston Naming Test*; Kaplan, Goodglass, & Weintraub, 1983, *Western Aphasia Battery;* Kertz, 1982, and *Action Naming Test*), relative to pretreatment. No significant differences were found between the treatment groups on language assessments with between-group analyses. However, on an individual basis, the majority of participants in the ILAT group (three out of four) demonstrated posttreatment improvements on overall language abilities and maintained those gains found immediately following treatment at one month follow-up; whereas only one of the participants in the comparison treatment group demonstrated immediate gains and maintained treatment gains. Maher et al.'s (2006) findings provide modest support for improvements in language abilities in response to ILAT. However, the fact that some individuals did not demonstrate improvements in language abilities in response to ILAT suggests the need for further research. Perhaps communicative changes associated with ILAT would be better demonstrated with other outcome measures.

***Social-functional communication assessments: Communication ratings.*** Social-functional communication has been assessed in previous studies of ILAT with ratings of participants' social-functional communication abilities by clinicians, participants, or communication partners, using the *Communicative Activity Log* (CAL; Pulvermuller et al., 2011) and/or the *Communicative Effectiveness Index* (CETI; Lomas et al., 1989). The *Communication Effectiveness Index* (CETI) is considered a reliable and valid rating scale of social-functional communication (Lomas et al., 1989). For the CETI, communication partners (i.e., people who communicate with the individual with aphasia on a regular basis) rate the social-functional communication of the individual. The CETI was used in the aforementioned study by Meinzer and colleagues (2005). Recall that the researchers compared ILAT to a modified-ILAT approach that included home-practice of everyday communication skills and found no difference either immediately or at 6-months post intervention on measures of language performance or social-functional communication, as measured by the CETI. Both groups, however, improved significantly on the CETI. The CETI may provide an important outcome measure for ILAT because associated changes may suggest, socially significant changes or improvements in communication skills necessary for day-to-day social communication (Goral & Kempler, 2009).

The *Communicative Activity Log (*CAL) was developed specifically for use in ILAT studies (Pulvermuller et al., 2001). Pulvermuller and colleagues stated that each participant in the original ILAT study, receiving ILAT, demonstrated improvements on the *CAL*, when rated by clinicians blinded to treatment-type. Meinzer et al. (2005) supported the claim with post-treatment improvements found in CAL relative to baseline, and gains remaining stable at the six-month follow-up for both ILAT groups (i.e., ILAT group and a modified ILAT group that included home-practice of everyday communication). Participants and a relative of each participant provided the CAL ratings.  Unlike the CETI, the CAL has not yet been examined in order to determine its reliability and validity.

Although both the CAL and the CETI are potentially valuable assessments of social-functional communication abilities, they do have limitations.  Both measures rely on ratings by clinicians, participants, or by a proxy of participants' indirectly describing everyday social-functional communication abilities of the individual with aphasia.  Perhaps changes in social-functional communication could be further examined through direct and, perhaps, more objective measurements of participants' performance using an instrument such as *The Communication Activities in Daily Living* (CADL-2; Holland, Porter, & Howard, 1999) and/or discourse analysis as described below.

***Social-functional communication assessments: Discourse abilities.*** Three previous studies have included the assessment of narrative discourse abilities as an ILAT outcome. Discourse analysis may be considered a direct measure of social-functional communication of individuals with aphasia.  First, in the study by Maher et al. (2006), narrative discourse abilities during the re-telling of the Cinderella story were examined for post-treatment change in relation to pre-treatment performance (i.e., as measured by change in the number of words, utterances, and sentences and mean length of utterances).  Improvements were found in three of the four ILAT participants immediately following ILAT, and in all four participants at a one month follow-up testing.  Only two participants, in the modified comparison group, were found to improve narrative discourse abilities immediately following treatment, with continued gains reported in one participant who was able to complete the follow-up narrative discourse assessment.  These findings suggested mixed results in order to support changes in discourse abilities in response to ILAT.

Faroqi-Shah and Virion (2009) studied changes in discourse abilities in response to ILAT, using the retelling of the Cinderella narrative (as introduced in the Maher et al. study). Due to experimental error, however, results for one of the two participants in the ILAT group could not be provided. The researchers reported no consistent pattern in response to ILAT, as measured by morpho-syntactic analysis of discourse measures (e.g., examining verb and argument structure word order and grammatical morphology). These mixed findings indicated the need for further examination of individual response to ILAT as measured by discourse analysis.

Discourse analysis was also completed in an examination of response to ILAT in individuals with acute (< 6 months post-onset) aphasia (Kirmess & Lind, 2011). Kirmess and Lind demonstrated changes in response to ILAT using analysis of discourse in dialogical interviews, as demonstrated by increased production of nouns and informativeness. Since these changes, however, were during a time-period post-stroke that is typically associated with spontaneous recovery, further research is warranted to examine changes in discourse production in response to ILAT.

**Secondary outcomes.** As a reminder, secondary outcomes refer to outcomes that may not be a primary objective for the treatment, but relate to the main treatment objectives. Potential secondary outcomes of ILAT have been relatively unexamined. Two areas worth considering as secondary outcomes include cognitive-communication abilities and client/participants' perceptions and values (Frattali, 1998).

***Cognitive-communication abilities.*** Cognitive-communication abilities are defined by ASHA (2005) as cognitive abilities other than speech-language skills that can impact communication. Aspects of cognitive-communication may include attention, memory, executive functions, and visuospatial skills. Global assessments of cognitive-communication abilities for individuals with aphasia typically include a nonverbal means for assessing the aspects of cognitive-communication, which correlate highly with verbal assessments of cognition (Helm-Estabrooks & Albert, 2004). Two assessments that provide a nonverbal method for assessing cognitive-communication abilities are the *Cognitive-Linguistic Quick Test* (CLQT; Helm-Estabrooks, 2001) and the *Raven's Coloured Progressive Matrices* (Howard & Patterson, 1992). The CLQT included subtests that individually assess each of the aforementioned aspects of cognitive-communication abilities. The Raven's uses a nonverbal puzzle-type task where the puzzle piece, out of a choice of six that best fits a particular design is chosen. The Raven's may be described as an assessment of nonverbal problem solving or analogical reasoning abilities. Previous research examining other aphasia treatments has suggested that more impaired cognitive-communication abilities (as measured by the Raven's) may have been related to poorer performance in response to treatment (Beeson, Rising, & Volk, 2003; Helm-Estabrooks & Albert, 2004; Wambaugh, Cameron, Kalinyak-Fliszar, Nessler, & Wright, 2004). Assessments of cognitive-communication abilities may assist in explaining response to a treatment and should be included in a comprehensive assessment in aphasia treatment research. Assessments examining cognitive-communication abilities in response to ILAT have not yet been included in ILAT research.

***Client perceptions and values.*** Client perceptions and values should be an integral part and focus of clinical practice for communication disorders, according to the American Speech-Language-Hearing Association (ASHA, 2004). Understanding the perceptions of individuals with aphasia on an aphasia treatment is critical, because if a treatment is perceived as negative or unsatisfactory, it may be avoided completely, regardless of whether or not the treatment is effective (Schwartz & Baer, 1991; Wolf, 1978). There is only one previous ILAT study in which client perceptions and values related to ILAT were examined (Kirmess & Maher, 2010). The study provided ILAT training to three participants with acute non-fluent aphasia, a sub-population of individuals with aphasia, who have particular difficulties with spoken language production. Spoken language production in individuals with aphasia can be described in terms of fluency, or the amount of speech produced in a single breath unit, with individuals with non-fluent aphasia (e.g., Broca's aphasia) producing less spoken language production, compared to fluent aphasia (e.g., Wernicke's aphasia) (Helm-Estabrooks & Albert, 2004). A summary of the results across the three participants revealed that they reported positive experiences with ILAT in general. Two of the participants would have preferred fewer hours or treatment per day; and, one participant would have preferred increased intensity of training. These findings provide a starting point to understanding the perceptions of ILAT by people with aphasia.

**Proximal outcomes.** Finally, proximal outcomes, or outcomes related to skills directly trained during ILAT, such as the verbal request, have been relatively unstudied and may provide a potentially valuable index of ILAT effectiveness. In order for improvements to occur in primary and secondary outcomes, it is logical that improvement must first be demonstrated in skills directly trained during ILAT.

Faroqi-Shah and Virion (2009) conducted one of the first studies that addressed proximal outcomes in response to ILAT. These researchers compared ILAT (*n*=2) to a modified ILAT (*n*=2) that included additional rules during the ILAT language-game. The rules used by Faroqi-Shah and Virion required participants to produce an adverb and appropriate tense morphology during the typical ILAT tasks. Participants were four individuals diagnosed with nonfluent aphasia, with two in each group. The participants were classified as having Broca's aphasia.

One of the hallmark characteristics of Broca's aphasia is agrammatism or the inability to use words in a grammatical sequence (Helm-Estabrooks & Albert, 2004). The modified ILAT, with the inclusion of additional grammatical requirements, was meant to address specific language deficits of participants. Indeed, gains were found on a measure of syntactic abilities, a potential proximal outcome, immediately following treatment only in the modified ILAT group. All four participants also demonstrated gains on at least one of the other measures of language-impairment, including a more global language assessment, the *Western Aphasia Battery-Revised* (WAB; Kertesz, 2007), and assessments of naming abilities, the *Boston Naming Test* (Kaplan, Goodglass, & Weintraub, 2000) and the *Object and Action Naming Battery* (Druks & Masterson, 2000). Participants demonstrated small gains at posttreatment on an assessment of discourse, although there were no apparent patterns that distinguished the two groups. Although the findings from the study provided some support for the gains in language abilities in response to ILAT, generalization of the gains to outcomes measures of social-functional communication was not confirmed. Additionally, proximal outcomes were only measured in relation to the modified ILAT group. Further research is needed to examine proximal outcomes of the typical ILAT.

Another study attempted to examine proximal outcomes of ILAT and support the ILAT principle of focusing (Kurland, Pulvermüller, Silva, Burke, & Andrianopoulos; 2012). Kurland and colleagues aimed to demonstrate improvements in confrontational naming skills (i.e., providing a one-word response to name a picture card) that were trained during ILAT. The participants were two individuals with nonfluent aphasia, moderate to severe in severity with co-occurring apraxia of speech (i.e., speech programming deficits). The researchers compared ILAT with a similar treatment, Promoting Aphasics' Communicative Effectiveness (Davis & Wilcox, 1985), which unlike ILAT, allows the use of any form of communication (e.g., gestures, written, drawing). During the treatments, participants completed social-functional communication tasks targeting the ability to verbally request picture cards from one another, as typically done in ILAT studies. The participants demonstrated improvements in confrontational naming abilities that were trained during treatment (i.e., a potential proximal outcome), resulting in medium to large effect sizes, with more robust improvements found in response to ILAT. The study by Kurland et al. (2012) included an outcome measure that was meant to specifically assess proximal outcomes. However, studying only confrontational naming skills, and not examining the entire verbal request directly trained during ILAT as a potential proximal outcome, may have limited these findings.

**Summary.** Table 1.1 provides a summary of the studies discussed above in relation to the outcome measures used. It can be seen that language measures, one of the primary outcome areas for ILAT intervention, were used most often across the studies. No study to date has utilized an objective assessment of changes in multimodal social-functional communication, although one study used the CETI and two used the CAL, subjective rating scales of social-functional communication. Discourse analysis is another method of indexing changes in social-functional communication, and two studies have included the outcome measure with mixed findings. Changes in cognitive-communication skills and positive (or negative) client perceptions are two potential valuable secondary outcomes of ILAT. No ILAT study to date has examined cognitive-communication skills in response to ILAT. Client perceptions have only been assessed in one ILAT study that included participants with aphasia who were at a time (post-stroke) of spontaneous recovery, which may have influenced the findings (Kirmess & Lind, 2009). Proximal outcomes were only assessed in two studies to date. The proximal outcome measures previously used in the studies were not ideal for describing changes in the skills directly trained during ILAT. The most important observation from examination of Table 1.1 is that no study to date has provided a comprehensive assessment of potential ILAT outcomes.

Perhaps one reason for a lack of comprehensiveness of outcomes assessment is that it would be difficult to adequately assess all of the outcomes in a group study design. Single-subject designs may provide a more realistic approach to comprehensive assessment of outcomes of ILAT intervention. Indeed in the first studies of ILAT, limited descriptions were provided for individual results. Results were averaged across participants in these group studies (Meinzer et al., 2005; Pulvermuller et al., 2011). The research included heterogeneous samples of individuals with various aphasia types and severities (Cherney, et al., 2008). Clinical outcomes averaged across a group of heterogeneous participants may mask individual differences. There is great variability both within and across individuals with aphasia in test-retest communicative performance and presentation of language impairments, even within particular aphasia types (e.g., Broca's or Wernicke's aphasia) (Erickson, Goldinger, & LaPointe, 1996).

The focus on pre-test/post-test group designs in aphasia intervention studies has been criticized as such designs do not allow for assessment of the variability in response to treatment (Barlow, Nock, & Hersen, 2009; LaPointe, 1978; Wambaugh, Nessler, Cameron, & Mauszycki, 2010). Since the majority of previous ILAT studies utilized group designs, they provide little evidence for which participants benefitted most from ILAT, and why. Indeed, further examination of individual response to ILAT is needed, given the fact that there were certain individuals in the group studies who showed improvements in language abilities and others who did not. Reviews on the last decade of ILAT literature indicated that future ILAT research should better describe individual response to ILAT on outcome measures that assess primary

Table 1.1

*Outcome Measures of Previous ILAT Research in Individuals with Chronic Aphasia*

| | Language | | Social-Functional Communication | | | Cognitive-Communication |
|---|---|---|---|---|---|---|
| ILAT Literature | Overall Language | Other Language Skills/Subtests | Multimodal Communication | Communication Ratings | Spoken Discourse | Cognitive-Communication |
| Pulvermuller et al. (2001) | AAT<br>**not reported* | X | X | CAL<br>**all positive changes* | X | X |
| Meinzer et al. (2005) | AAT<br>**4/12 did not show improvements* | X | X | CAL & CETI<br>**all positive changes* | X | X |
| Maher et al. (2006) | WAB<br>**1/4 did not show improvements* | BNT<br>**0/4 did not show improvements*<br>ANT<br>**2/4 did not show improvements* | X | X | Retelling Cinderella Story<br>**1/4 did not show improvements* | X |
| Faroqi-Shah & Virion (2009) | WAB<br>**1/2 did not show improvements* | BNT;<br>OANB subtest<br>Verb Inflection Test<br>**not all reported-each improved on at least 1 language measure* | X | X | Retelling Cinderella Story<br>**missing results for one participant; 1/2 did not show improvements* | X |
| Kurland et al. (2012) | BDAE<br>**1/2 did not show improvements* | Confrontational Naming<br>**2/2 did not show improvements*<br>BNT<br>**1/2 did not show improvements* | X | X | X | X |

*Note.* *= Individual participant outcomes on each assessment. WAB = Western Aphasia Battery. BNT = Boston Naming Test. ANT = Action Naming Test. CAL = Communicative Activity Log. CETI = Communicative Effectiveness Index. BDAE = Boston Diagnostic Aphasia Evaluation. AAB = Aachen Aphasia Test objectives of ILAT, such as spoken language production *and* social-functional communication, assess skills thought to be related to ILAT outcomes (i.e., *secondary outcomes*), assess functions directly trained during ILAT (i.e., *proximal outcomes*), and examine participant perceptions of ILAT (Cherney, et al., 2008; Meinzer, Rodriguez, & Gonzalez Rothi, 2012).

**Purpose, Research Questions, and Hypotheses**

The purpose of the current study was to determine the effectiveness of ILAT in individuals with nonfluent aphasia with a comprehensive examination of potential outcomes, including language, social-functional communication, cognitive-communication, directly trained skills during ILAT, and patient perceptions. Although, ILAT has been suggested to be applicable to all aphasia types (Pulvermuller et al., 2001), individuals with nonfluent aphasia were included in this study because, as mentioned previously, individuals with nonfluent aphasia (e.g., Broca's aphasia) produce less speech, compared to fluent aphasia (e.g., Wernicke's aphasia) (Helm-Estabrooks & Albert, 2004). Also, choosing to include individuals with a similar deficit relates to ILAT being held in a group setting. When treatment is held in a group setting, as in ILAT, some researchers suggest that it may be easier to manage cohesiveness and allow for more equal participation and practice among group members when participants present with similar communicative abilities (Marshall, 1999). Although more recent ILAT studies have focused on individuals with nonfluent aphasia, none have done so using a comprehensive assessment of potential ILAT outcomes. The primary research questions were as follows:

1. Will each participant with nonfluent aphasia demonstrate improvements on a social-functional communication task on trained and untrained items (proximal outcome)?

2. Will performance by participants on a social-functional communication task generalize to improvements on post-treatment measures of social-functional communication and language abilities (primary outcomes)?
3. Will performance by participants on a social-functional communication task generalize to improvements on post-treatment measures of cognitive-communication abilities (secondary outcome)?
4. Will participants report positive perceptions associated with the ILAT program (secondary outcome)?

Individuals with nonfluent aphasia were predicted to demonstrate improvements on measures of proximal outcomes, or directly trained items (as measured by visual inspection and an effect size), indicating an improvement in response to ILAT on a common and important communication task of requesting that requires spoken language production and social-functional communication. As noted in previous ILAT research, the participants were predicted to demonstrate generalization of changes in proximal outcomes to changes in primary measures of language. Additionally, gains in other measures of social-functional communication, as well as to secondary measures of cognitive-communication were expected. Participants were predicted to perceive positive experiences associated with the ILAT program. Finally, regardless to whether or not these hypotheses were confirmed, this study aimed to provide the aphasia community with a better understanding of the potential outcomes of ILAT in individuals with nonfluent aphasia.

## Chapter Two: Methods

### Experimental Design

The design for the current study was a *single-subject, multiple baseline design across behaviors*. Each participant who met study criteria completed the following schedule: (1) *developing card sets* by first naming 260 stimuli items, (2) *baseline testing* with the experimental stimuli (i.e., card sets) and an initial *assessment battery (pre-tests)*, (3) an intensive two-week (i.e., two and a half hours/day for 10 week days), 25-hour-total treatment program with ongoing probing of experimental stimuli, (4) post-testing with the initial assessment battery and experimental stimuli.

**Developing experimental card sets.** A revised set of the 260 commonly used Snodgrass and Vanderwart's (1980) line drawings of objects in gray-scale and color by Rossion & Pourtois (2004) was printed on standard wallet-size cards and utilized as experimental stimuli. In order to develop the experimental card sets, participants named each of the 260 picture cards once with an unlimited response time. Based on all responses across all participants, six sets of cards were selected. These chosen sets were reprinted single-sided on card-stock (approximately 2 inx8 1/2in). Each set included 10 cards: seven cards that were named incorrectly and three cards that were named correctly by all participants. The six sets of 10 cards each included some incorrect and some correct items for two reasons. First, the inclusion of some correctly named items was meant to reduce frustration for participants during the treatment program. Second, some correctly named items were included to fulfill a requirement of the chosen data analysis procedure for calculating effect sizes, requiring a naming score of greater than zero at baseline.

Along with having the sets balanced for items initially named corretly and incorrectly by each participant, sets were also balanced for intrinsic features within the chosen card set (Rossion & Pourtois, 2004). Normative data have been collected by Rossion and Pourtois (2004) on the 260 drawings that were used in the current study. Two hundred and forty college students (age range 18-22) named the drawings and provided ratings (using 1-5 scales) in order to determine familiarity of image, agreement of image and its name, and visual complexity. These features, along with number of syllable and letters, frequency of use in everyday language, and semantic category, were used to balance the the six sets of stimuli as much as possible in order to reduce a potential influence of the card sets on treatment outcome (Battig & Montague, 1969; Francis & Kucera, 1982; Rossion & Pourtois, 2004; Uyeda & Mandler, 1980). The characteristics of each set is provided in Appendix A.

First the sets were balanced informally by viewing the data of the drawings and randomly placing cards of simliar values (1-5) into different sets. Next, an average of the values were determined by using the normative data for each of these variables for each set. Then an analysis of variance (ANOVA) was conducted to determine whether or not differences existed between sets. When a significant difference existed ($p<.05$), the researcher attempted to determine which values contributed to the difference by doing a visual inspection of the values for each set (with avaerage values 1-5) and reorganized the cards into different set or excluded the card from the sets until no significant differences existed between sets, as indicated by individual T-tests analyses and an ANOVA. The four treatment sets were identical for all four participants, since the treatment was conducted in a group. The two remaining of the six sets of experimental stimuli were randomly assigned to one *response generalization set* and one *exposure control set*.

**Baseline testing.** The protocol developed by Kirmess et al. (2011) to probe experimental stimuli was used (see Figure 2.1). The protocol required the participants to request a picture card from the clinician. The picture cards probed were five randomly chosen cards; these probing cards were chosen from each of the four treatment sets and from the response generalization and exposure control sets. Experimental stimuli were probed without feedback. Each of the required elements in the requesting task was worth a possible 2 points (2=correct, 1=mostly correct, 0=incorrect). The points were converted to a percentage out of 100 after each baseline testing session and plotted on a graph, modified from the Base-10 Programmed Stimulation Response Form (LaPointe, 1977). Baselines were extended across subjects until no more than 20% variability was found across three consecutive baseline sessions immediately preceding the application of treatment. The baselines obtained before the application of treatment on the first training set is known as the 'true baseline' for all sets.

**Treatment phase.** Once a baseline was established, training was applied to the first treatment set. All treatment sets were probed (trained and untrained sets) at the beginning of each session. Probe sessions were not conducted on the second day of treatment due to experimenter error. The criteria for probing during the treatment phases was that training on the first set continued until at least two participants reached the training criterion of 80% accuracy. When one or two participants had not yet achieved criterion while others had, training on that set was required to continue for up to three days/treatment sessions. Then, treatment was withdrawn from the first treatment set and was applied to the second treatment set. Probing was continuously conducted until treatment and the withdrawal (i.e., maintenance phase) was terminated with the second set.

**Maintenance phase.** Once the next treatment set was introduced, the first treatment set was only targeted for homework (described below in treatment enactment section). All sets of stimuli was continuously probed throughout maintenance periods (and baseline and post-testing), allowing the researchers to assess whether or not a response to treatment occurred only when treatment was provided. Participants were only able to meet criteria for treatment sets 1 and 2. Therefore, treatment sets 3 and 4 were not utilized during treatment or maintenance.

**Response generalization and exposures sets.** Two of the six sets of experimental stimuli were randomly assigned to a 'response generalization set' (i.e., presented only during baseline and post-treatment testing sessions) and an 'exposure control set' (i.e., presented during each probe assessment but not used during treatment). Previous research has found that repeated exposure of probes may affect proximal outcomes even without treatment (Wambaugh & Ferguson, 2007). The performance on each of these two sets was compared to determine whether or not exposure of sets during probing influenced outcomes.

**Control task.** A control task of non-word repetition from the *Psycholinguistic Assessment of Language Processing in Aphasia* (PALPA; Kay, Lesser, & Coltheart, 1992), repeating non-words read aloud by experimenter, was continuously probed throughout maintenance periods (and baseline and post-testing). Change in the participants' performance on a control task could suggest non-specific treatment effects or spontaneous recovery (Nickels, 2002). This control task was selected, because non-word repetition abilities were not expected to be affected by the treatment. However, non-word repetition (and the social-functional communication task) requires spoken language production. Extraneous factors (e.g., change in medicine) impacting spoken language production would be expected to impact performance on this control task and on the social-functional communication task.

ID: _________ Phase: __________________________

Date: ________

Experimenter: __________

Instructions (modified from Kirmess, 2011): *"I will show you a picture. Can you produce a question about the picture? Your question should include an addressing (my name), a question phrase, the object (in other words what the picture shows), and a property of the object. For example, "Rachel, do you have two black pens?" Now you try.*

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Picture Card/Concept | | | | | | | | | | |
| Carrier Phrase | | | | | | | | | | |
| Number | | | | | | | | | | |
| Description/ Property | | | | | | | | | | |
| Object Name | | | | | | | | | | |
| **Total Points** | | | | | | | | | | |

(2=correct, 1=mostly correct, 0=incorrect)

Points converted to percentage: __/100 %

*Scoring instructions:*

• If participants self-correct or change a response, score the correction/changed response

• With the carrier phrase, one point if given if the participant provides the name of the opponent and one point is given for the question phrase (for a total of two points possible)

• With the number requirement, if the number provided on the picture card does not match the number given by the participant, a zero is scored. If the correct number is given with 2-3 phonemic errors, one point is scored. If the number is given with one phonemic error or no phonemic errors, two points are scored.

• The description/property given must be present in the picture card to receive credit. A description/property given for an item may be scored as one point it does not represent/describe the main properties within the picture, but does describe some property within the picture card/item.

•The object name may be in the singular or plural form to receive full credit (two points), and differences will not count as a phonemic error.

• The object name may contain one phonemic error to receive full credit (two points). If two or three phonemic errors occur, but the word is recognizable as the target word, the participant receives one point.

*Figure 2.1.* Probe administration form.

## Participants

Four individuals, three females and one male, with chronic nonfluent aphasia were recruited by flyers and referrals from a nonprofit aphasia center in the Triangle area of North Carolina, the Triangle Aphasia Project, Unlimited. Participant's ages ranged from 43 to 57 years. Participants were screened for depressive symptoms using the *Geriatric Depression Scale* (GDS; Yesavage et al., 1983). The GDS was utilized because the tool can be completed with a limited use of language compared with other screening instruments for depression. Participants also were asked if they were currently taking antidepressants. Participants were not excluded if they presented with depressive symptoms, but these findings were used to describe participants' characteristics. Demographic information and participant characteristics in regard to inclusion and exclusion criteria of particular interest for the present study are displayed in Table 2.1. More detailed descriptions of participant characteristics will be provided in Chapter 3 in case reports.

**Inclusion criteria.** The participants with aphasia were required to be at least 21 years old and no more than 80 years. One common communication partner of at least 21 years of age for each participant with aphasia was also required for participation. Participants were required to have sustained a single left-hemisphere occlusive or hemorrhagic cerebral vascular accident and to be more than six months post-onset. The criteria for participation included pre-morbid speakers of English, hearing and vision corrected to within functional limits for completing experimental tasks and no other history of neurologic or psychiatric disorder. One participant (B.J.) had corrected hearing with the use of a hearing aid. The remaining participants passed hearing screenings of pure tone air conduction thresholds of no greater than 40 dB at 500, 1000, 2000 Hz bilaterally on an audiometer with up-to-date professional calibration.

**Exclusion criteria.** Exclusion criteria required that individuals with fluent aphasia were excluded, as measured by the *Aphasia Diagnostic Profiles* (ADP; Helm-Estabrooks, 1992). Individuals with moderate to severe or severe to profound apraxia of speech were excluded, using the Apraxia Battery for Adults-2 (ABA-2; Dabul, 2000) subtest 2A (repeated words) and using a checklist to determine the presence, inconsistency, or absence of cardinal features of apraxia of speech (McNeil, Robin, & Schmidt, 1997). This criteria was important because based on previous research it seems advantageous for ILAT participation to have relatively spared spoken language production abilities, including knowledge about oral motor positioning (Kirmess & Maher, 2010).

Table 2.1

*Characteristics of Four Participants with Nonfluent Aphasia*

| *Participants* | *A.C.* | *B.J.* | *C.G.* | *D.B.* |
|---|---|---|---|---|
| Age | 51 | 57 | 43 | 55 |
| Gender | F | F | M | F |
| Date of Stroke (MPO) | 84 | 40 | 37 | 236 |
| Handedness (pre/post stroke) | R/L | L/L | R/L | R/L |
| Education (years) | 16 | 16 | 16 | 12 |
| Race | AA | C | C | AA |
| GDS; HX of depression/anti-depressants | 4; no/no | 2; unknown/yes | 4; no/no | 6; no/no |
| Marital status | married | divorced | married | single |
| Occupation | homemaker | sales worker | sales worker | crafts worker |
| Socioeconomic status * | ** | 2 | 2 | 3 |

*Note.* MPO = months per onset; AA = African American; C = Caucasian; GDS = Geriatric Depression Scale (Yesavage et al., 1983) with greater or equal to 5 suggesting depression; * = Calculation of socioeconomic status based on the Four Factor Index (Hollingshead, 1975); ** = unable to calculate secondary to occupation

**Sample size and Attrition.** The sample size for the present study was n=4. Previous ILAT research has included varying numbers of participants with aphasia, commonly 2-3 individuals with aphasia, with and without clinicians as a player in the language games during ILAT (Maher et al., 2006; Pulvermuller et al., 2001). In the present study, the clinician was not a player in the language-games. A sample size of four was chosen because previous ILAT research suggested the use of four players for the language-games during ILAT (described further in the ILAT treatment protocol section) (Pulvermuller et al., 2008). Furthermore, a practical consideration for targeting four participants in one group was that current Center for

Medicare and Medicaid Services recommendations require four patients in a group therapy session.

A minimum of 80% attendance to all treatment session was required for participation in the study. Participants were required to have own means of transportation to site location. Therefore, transportation could have been one unpreventable cause of attrition. One participant (i.e., D.B.) missed one assessment day due to transportation/scheduling difficulties and one treatment day due to medical complications (described in discussion section). Given that the participants received a free aphasia treatment the amount of attrition was expected to be low. If attrition consisted of more than one participant the study would have been completed and then repeated again with four new participants. However, each participant was able to complete the study.

### Pre- and Post-Treatment Assessments

Pre/post-testing required approximately five hours across five sessions for each participant. Informed consent was collected from each participant with aphasia and a common communication partner, following the guidelines approved by the University of South Florida Institutional Review Board (Appendix F), including the use of a pictographic format with key words and an assessment for comprehension of the information within the consent form for each participant with aphasia. The administration of assessments was videotaped or audio taped. All tests were conducted by a speech-language pathologist experienced with assessment procedures.

**Assessments for describing participants.** Assessments that were used to describe the participants were administered at baseline. The PALPA subtests and screenings for depression and apraxia of speech were used only pre-treatment. The remaining assessments were also repeated at post-testing to assess response to treatment.

***Language abilities.*** Subtests from the *Psychological Assessment of Language Processes in Aphasia* (PALPA; Kay et al., 1992), *Pyramids and Palm Trees Test* (Howard & Patterson, 1992), *Boston Naming Test* (BNT; Kaplan, Goodglass, & Weintraub, 1983), and the *Aphasia Diagnostic Profiles* (ADP; Helm-Estabrooks, 1992) were administered to examine language abilities.

*Overall language abilities.* A battery of language subtests, the *Aphasia Diagnostic Profiles* (ADP; Helm-Estabrooks, 1992), was administered as an overall assessment of language functioning.

*Picture and word semantics.* Measured for percent accuracy of subtests of categorization and spoken- word/picture matching, and written word/picture matching using the *Psychological Assessment of Language Processes in Aphasia* (PALPA; Kay et al., 1992) subtests 47, 48, and 51, and the *Pyramids and Palm Trees Test* (Howard & Patterson, 1992).

*Rhyming.* Measured by percent accuracy and influence of semantic foils on subtests of pictorial input-word pairs, pictorial and verbal input, and pictorial/spoken input-field of four items on the PALPA subtests 14 and 15.

*Picture naming.* Measured by error types and paraphasias in response to confrontational naming on the *Boston Naming Test* (BNT; Kaplan et al., 1983), and may be used as a direct comparison to previous ILAT studies.

*Phonemic cueing responsiveness.* Measured by response to first sound cueing during confrontational naming on the *Boston Naming Test* (BNT; Kaplan et al., 1983).

***Social-functional communication.*** Along with the social-functional communication task of requesting administered in the probes, *The Communication Abilities in Daily Living* (CADL-2; Holland, Porter, & Howard, 1999) and the Communicative Effectiveness Index (Lomas et al.,

1989) were administered. The CETI was completed by a communication partner of the participant with aphasia.

Two discourse samples were collected. Performance was analyzed for words per minute and percent correct information units (CIUs) in discourse production for each discourse stimuli (Nicholas & Brookshire, 1993; Yorkston & Beukelman, 1980). All samples were transcribed using *ExpressScribe Transcription Software*. A narrative sample was elicited by asking participants to look through a wordless picture book of the Cinderella story and to retell the story (Grimes, 2005; MacWhinney, Fromm, Holland, Forbes, & Wright, 2010). Additionally, a picture description was used, 'the cookie theft picture,' from the standardized *Boston Diagnostic Aphasia Examination* (BDAE; Goodglass, Kaplan, & Barresi, 2001). The Cookie theft has not been used in ILAT research previously.

Compared to language assessments that describe "impaired components of the language system" (Jacobs, 2001, p. 115), these discourse measures provide an assessment of how individuals use language in the context of actual communication situations. Discourse samples are typically measured with a number of different stimuli (e.g., picture stimuli, requests to give procedural directions, request for personal information), providing consequently longer speech samples for each participant and different communicative contexts (Brookshire & Nicholas, 1994). The Cinderella narrative has been used in the past as a measure of ILAT outcomes (Faroqi-Shah, 2009; Kirmess & Lind, 2011; Maher et al., 2006). An additional discourse stimulus, the Cookie Theft picture, was included in order to provide another communicative context. Also, since the individuals in the present study were nonfluent (i.e., with pretest speech samples averaging 48 words total), the addition of describing Cookie Theft picture as a discourse task provided more discourse for analysis. The Cookie Theft is also a structured task, which helps to provide an efficient method for collecting discourse samples, with ecological validity.

***Cognitive-communication abilities.*** To measure cognitive-communication domains, including attention, executive functioning, visuospatial abilities, and memory, the *Cognitive-Linguistic Quick Test* (CLQT; Helm-Estabrooks, 2001) was administered. The *Raven's Coloured Progressive Matrices* (Howard & Patterson, 1992) was included as an assessment of nonverbal problem solving and analogical reasoning.

**Assessments for measuring treatment response.**

***Post-testing.*** Pre-tests for overall language, cognitive-communication skills, social-functional communication and level of deficit were repeated at post-testing.

***Measuring response to treatment.*** In addition to the pre/post-test battery, treatment probes were utilized as outcome measures as described in the research design section above. .

**Participant Experience Survey of participants' perceptions of ILAT.**

The Participant Experience Survey, developed by Kirmess (2011), was administered post-treatment in order to examine the participants' perception of the treatment process with use of five open-ended questions and 15 closed questions, such as, *"Can you tell me what you think about the training program? The program we have used the last 10 days."* and "*To which degree did the intensity of the training match your needs?*" (see Figure 2.2) (Kirmess, 2011). The closed-ended questions used a likert scale, along with pictures, symbols, and written key words to reduce the amount of language abilities needed to complete the survey. The 5-point likert scale asked the participants to rate the questions with the format, *to a very high, high, neutral, low, very low degree.*

**Open-ended questions:**
1. *'Can you tell me what you think about the training program? The program we have used the last 10 days.'*
2. *'Is there something you liked especially well?'*
3. *'Is there something you did not like or experienced as negative?'*
4. *'Are there any other language areas you would like to have more training in?'*

**Closed-ended questions with picture support:**
1. *'To which degree did you like to participate?'*
2. *' To which degree did you like the picture material?'*
3. *'To which degree were the different categories' appropriate for you?*
4. *' To which degree did you like the different levels of difficulty?'*
5. *' To which degree did the different levels of difficulty match your needs?*
6. *'To which degree did you experience the training as exhausting?'*
7. *'To which degree did you experience the training as monotonous?*
8. *' To which degree did you experience the raining as useful?'*
9. *'To which degree did the intensity of the training match your needs?*
10. *'Would you liked to change the number of trainings hours per day?'*
11. *'To which degree did the intensive language training fit with the rest of your daily program?'*
12. *' To which degree did you experience any changes compared to before we started with this?'*
13. *' Is this change on the positive or negative side of the axis?'*
14. *' To which degree did the program fulfill your expectations?*
15. *'Would you participate again?'*
16. *' Is there anything else you would like to comment? Anything I have not asked you about?'*

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*Figure 2.2.* Participant Experience Survey (developed by Kirmess & Maher, 2010).

## Reliability for Response to Treatment and Pre/Posttreatment Assessments

Interjudge reliability for accuracy of scoring was checked by another individual other than the original examiner, a certified speech-language pathologist. Reliability training was completed on assessments that were not chosen for calculating reliability. Point-to-point agreement was used to determine reliability (i.e., total agreements/total agreements + total disagreements) (Salvia, Ysseldyke, & Bolt, 2007). The minimum acceptable value of interjudge reliability using point-to-point agreement typically ranges from 80 to 90 percent (Kratochwill et al., 2010).

Interjudge reliability for accuracy of scoring probe sessions in response to treatment for the present study was assessed using 21% of all sessions (13.4 randomly chosen probe sessions for the experimental sets). The average agreement was 97.2 %, with a range of 80 to 100 percent across all rescored sessions. Twenty percent of the probe sessions for the Control Task were selected for interjudge reliability as well. The average agreement was 87% with a range of 80 to 97 percent across all rescored sessions. The discourse production outcome measures were assessed for interjudge reliability separately (described below). Using recordings of sessions for administration of the remaining assessments within the assessment battery, 16 percent of all assessments (7.5 assessments) were also selected randomly for interjudge reliability. Reliability procedures included filling out blank assessment forms/transcripts and/or checking accuracy of scoring. Interjudge reliability for conducting the assessments within the assessment battery averaged 97% with a range of 91 to 100 percent across all rescored sessions.

Procedures for establishing interjudge reliability for ratings of discourse samples were based on those used by Cameron, Wambaugh, and Mauszycki (2010). Interjudge reliability for accuracy of scoring discourse samples was assessed using 25% of all samples (one randomly chosen sample for each participant). A speech-language pathologist, other than the one that originally scored the samples, calculated both words and CIUs independently. Mean point-to-point inter-rater agreement ranged from 83 to 100, averaging 94%.

**Treatment Procedure**

In order to determine the most probable cause of a clinically relevant change in behavior (e.g., requesting skills), independent variables and other possible confounding variables must be operationally defined, such as the "response parameters, including response time, what feedback is provided, and so on…in order for the treatment to be replicated, for both research and clinical purposes, it must be precisely described" (Thompson, 2006, pp. 274-275). The aim of this section was to describe the treatment in a manner that was as directly replicable as possible.

**Developing the treatment procedures.** Pilot research was conducted to develop a treatment manual based on treatment procedures implemented in previous ILAT studies. Participants were recruited by a flyer at the Speech-Language-Hearing clinic at the University of South Florida (USF). Two individuals expressed interest in the study, but one individual declined due to scheduling reasons within the individual's family. The participating individual had a single left-hemisphere stroke. She was classified as having Broca's aphasia on the ADP. The participant was allowed to continue a previously initiated aphasia therapy group at the USF clinic. The participant was a female native English-only speaker, pre-morbidly right-handed. She was 45 years old, Caucasian, married, and had a college education

The participant had an overall aphasia severity score in the 61$^{st}$ percentile and a lexical retrieval score in the 25$^{th}$ percentile on the ADP. She had relatively good auditory comprehension skills and non-linguistic cognitive-communicative skills. She scored in the 91$^{st}$ percentile on auditory comprehension on the ADP. On the CLQT for ages 18-69, she presented with moderate impairments in attention and memory, mild impairments in visuospatial skills, and to be within normal limits for executive functions. She scored within normal limits on the RCM assessment of abstract reasoning and analogical thinking.

Since the primary purpose of this pilot research was to establish treatment procedures, the typical treatment regimen of ILAT was not targeted. Instead the sessions were scheduled at the convenience of the participant. Sessions were conducted every few days over two and a half weeks, including approximately 10 hours of treatment total. The individual did not demonstrate clinically significant changes in response to the pilot research. Along with extensive review of the treatment protocol in previous ILAT research, the outcome of the pilot research was the development of the clinician manual provided in the Appendix B.

**ILAT treatment protocol.** The principle activity within ILAT involves a language game where the "action structure of this language game is that of a typical request communication" (Pulvermüller & Berthier, 2008, p. 577), however, at a recent conference Pulvermuller suggested many other language games that could be substitued for the present game and still considered an ILAT (Pulvermuller, 2011). In the present study, participants played a language game in which four participants had picture cards laid down in front of them and asked each other for cards in order to make pairs (similar to 'go fish'). If another participant had the card they respond by giving it to the person who requested. Participants were not, however, allowed to use other modes of communication, such as gestures or writing, to communicate. However, following the recommendations by Pulvermuller et al. (2008), if a participant was using a gesture behind their visual barrier as a self-cue without allowing the other participants to see the gesture or without using the gesture as the only means of communication, the gesture was permitted. The goal of ILAT was to focus communication on verbal production not to stop self-cues (e.g., gestures or hand movements) that may be naturally associated and combined with spoken language production (Pulvermuller et al., 2008).

**Setting.** The treatment was held in a quiet setting in a large treatment room at a square-shaped table. The clinician was seated on a rolling stool so that she may move around the table easily to assist group communicative acts and attempts. Four participants were seated facing each other at a table, separated visually by a barrier (see Figure 2.3 from Pulvermuller et al., 2008). Treatment was held daily for two weeks from 11:00am-2pm. Between 12 and 12:30pm participants had a break for a snack or lunch, sitting at a different table than where the treatment was held. The participants were not required to focus on the goal of treatment during the break. Participants noted daily that they were ready for a break at the beginning of the snack/lunch break and at the end of the daily sessions.

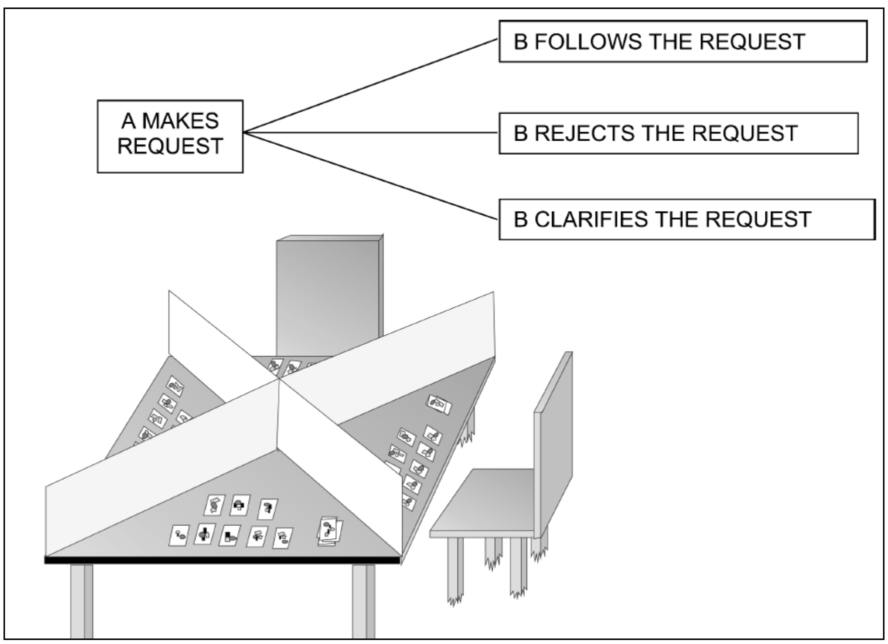


*Figure 2.3.* Setting of ILAT (reprinted from Pulvermuller et al., 2008).

**Treatment introduction.** First, the clinician described the rules of the treatment. Using a powerpoint presentation, including pictorial and key word assistance, the clinician described the verbal requirements of each turn within the game (viz., saying a teammates name, requesting an item, such as, "do you have?" providing an adjective/descriptor, and naming the object on the card). The clinician provided a video example of the treatment procedures, using picture card sets that were not used during any part of the training.

On the treatment-example video presentation, the clinician says, *"(research assistant's name), do you have four red pens?"* A research assistant says, *"Yes. I have four red pens"* and gives the match to the clinician. If a player gets a match that they requested either from an opponent or from the Go Fish Pile they take another turn. So the clinician gets to ask for another card (e.g., *"(research assistant's name), do you have three grey buses"*) and the assistant replies appropriately (e.g., *"No. I do not have three grey buses, Go Fish"***).** During each turn the video recording shows the hand dealt for the player making the request. So, for example, when the clinician asks the research assistant for a red pen, she looks at a picture of a black pen while saying, *"No. I do not have one red pen, Go Fish."* Next the clinician says, *"now it's (research assistant's name) turn."* The research assistant takes a turn asking the clinician for a card; and then the clinician takes one more turn. So the participant has three opportunities to watch the structure of the task before attempting it.

After presenting the treatment-example video, the clinician took the treatment card sets and laid them out on the table. The examiner asked the participants, *"What are the names for each of these pictures?"* and immediately encouraged the participants to talk amongst each other to figure out what each of the objects in the pictures were called. Next the examiner said, *"You will need to describe the pictures in order to get a match, because some of the pictures are similar. For example, there is a red shoe and a blue shoe. So if I asked for a shoe, you wouldn't know if I wanted the red one or the blue one. So you would say, "which one or which shoe?"*

The clinician and group members continued discussing each card until the group understood what each of the cards should be called.

**Rules.** The detailed treatment manual is provided in Appendix B. Shaping refers to "carefully controlled steps toward closer and closer approximations of the criterion behavior" (Holland, 1970, p. 378). In some ILAT, three components, i.e., the stimuli, game rules/requirements, and reinforcement contingencies/cueing, are considered to be shaped to the communicative abilities of each individual during ILAT (Pulvermuller & Berthier, 2008). The stimuli are shaped to participants' level of functioning. For example, picture cards of everyday items, that have been found to be easier to produce for individuals with aphasia, may be used initially. Later, after therapeutic gains, stimuli may be increased to include words that are less frequent in language (Pulvermüller & Berthier, 2008). The rules of the game, including the spoken language production requirements by the participants, are adjusted throughout the treatment program, shaping responses into successively better approximation, e.g., from word-level to sentence-level to including descriptor words (Cherney, Patterson, Raymer, Frymark, & Schooling, 2008). Additionally, the feedback provided by the clinician is individually adjusted by the therapist to each participant's therapeutic needs, e.g., cueing misspoken words using semantic associations that are personal to the individual.

Specifically, following modified procedures from the Maher et al. (2006) study, participants were initially allowed to provide partial requests (e.g., saying an opponent's name, asking for an object, but not describing the object). As gains were made by participants, the level of difficulty and request requirements were increased (see Figure 2.4). Once the request and response was provided, the turn was over. The game continued until each match within the deck of cards (i.e., training set) was found. Then the game started over with the training set re-shuffled.

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| Participants are required to use only spoken language production to complete communicative acts during the language game across three levels of difficulty, following the modified protocol of Maher et al., (2006).<br><br>Materials: Pairs of matching semantic categories cards; each item could be described by a descriptor noun: e.g., a red book, or an old shoe, but these descriptors are only required later in the treatment once participants are successful in levels 1 and 2.<br><br>Level 1: Shaping rule constraints: Object<br>Request: Speaker communicates: "book?"<br>Response: Opponent communicates: "yes + book" or "no + book"<br><br>Level 2: Shaping rule constraints: Carrier phrase + object<br>Request: Speaker communicates: "Sue, Do you have a book?"<br>Response: Opponent communicates: "Yes, Sue, Have a book." Or "No Sue, I do not have a book."<br><br>Level 3: Shaping rule constraints: Carrier phrase + number + object<br>Request: Speaker communicates: "Sue, Do you have two books?"<br>Response: Opponent communicates: "Yes, Sue, I do have two books."<br><br>Level 4: Shaping rule constraint: Carrier phrase + number + description + object<br>Request: Speaker communicates: "Sue, Do you have two red books?"<br>Response: Opponent communicates: "No, Sue, I do not have two red books." |

*Figure 2.4.* Treatment protocol and levels of complexity (modified protocol from Maher et al., 2006).

Following the protocol for ILAT by Pulvermuller and colleagues (2001, 2012), the stimuli were shaped to participants' level of functioning. For example, picture cards of everyday items within each card set, that were found to be easier for individuals to name, were introduced first (i.e., words of higher frequency (HF) in our language). These constituted approximately half of the set (i.e., four objects out of 10). With therapeutic gains, the remaining six picture cards with lower frequency word names also were introduced into the treatment (Francis &

Kucera, 1982; Pulvermüller & Berthier, 2008; Uyeda & Mandler, 1980). Participants were able to move up to the inclusion of the higher frequency cards on the second day of each treatment set. The criteria for moving on to include the low frequency cards was the ability from all participants to name all high frequency cards accurately across two turns.

**Cueing/feedback.** Group members were informed that they should not solely rely on the clinician to play the game in order to allow a more natural flow to the conversation. The group members were told that each group member should first attempt to request a card on their own initially; and each participant should be given 10-15 seconds to request independently. The relatively short timeframe to respond was meant to allow a conversational-like flow among group members. The clinician instructed group members that *"if a group member, after their initial attempt (in the 10-15 second time frame), does not provide all of the information needed for the request other group members should ask for the information or for a clarification."* For example, if a group member was at level 3 and asked another group member, *"Do you have the anchor?"* the respondent would be encouraged to reply, *"which anchor do you need?"* so that all of the necessary information was provided in the response. As previously mentioned by Pulvermuller et al. (2001; 2008), receiving requests for clarifications on an incomplete request from other group members allows the treatment to more accurately reflect a natural conversation and not that of a didactic therapy session. If the participant was unable to think of an opponent's name, the clinician would encourage participants to ask each other their names.

The clinician would provide positive reinforcement, while being honest to participants about their performance. For example, if a participant only provided a partial request of saying the object name once they had already passed Level 1, the clinician would say, *"Great job at providing your opponent, Mr. X, with the object that you are looking for, the anchor…Now we* *need some more information to complete your turn."* This could also cue another group member to ask for clarification.

During the language game, if a participant still could not come up with the requested object (word-level) after having 15 seconds to come up with the target, the clinician provided a hierarchy for developing personalized cues. The procedure for developing the personalized cue was modeled after the personalized cueing method of Marshall and Freed (2006). First, the clinician named the picture on the card. Next, the clinician told the participant to create a cue by saying, *"think of something special to help you to remember this object."* Next, the clinician elaborated, shaped, or modified the cue for content (to be associative/semantic) and length (to maintain the time constraints of the language game) and recorded each personalized cue for each participant. Finally, the clinician highlighted the relationship between the cue and the word. An example of the procedure by Marshall and Freed (2006) is provided below.

> Clinician: Presents item and gives name (e.g., ''This is bathrobe'').
> Participant: No response required.
> Clinician: Instructs client to create a cue. For example: ''Think of something special to help you remember *bathrobe*.''
> Participant: Responds. For example: ''Um, red, old, old, love it.''
> Clinician: Elaborates, shapes, modifies cue for content and length. For example, ''OK, it's old; it's red; you're really fond of it. Old, red, favorite; will that work?''
> Participant: Verifies.
> Clinician: Highlights relationship between cue and word. For example: ''OK, the word is *bathrobe*. The way you remember it is old, red, favorite.''
> Participant: Confirms, ''yes'' or ''no'' (p.105)

Once the picture name was determined the participant was required to say the word and then say the entire request. If the participant had only minimal disfluencies while saying the request, the participant would be asked to repeat the request up to two times after the clinician provided a model of the request. The clinician also held a list of the words used in treatment and would note the personalized cue with the participant's name next to the words on the list. In this way, she remembered which words were difficult for each participant and what personalized cues assisted participants in naming the difficult item. Additionally, during treatment an attempt was made to record each turn on a group score sheet (see Appendix C) to allow simultaneous data collection of all four participants. This helped the clinician to keep track of the level of performance of each participant and help 'shape' their required verbal productions (i.e., individual rules for the game) following the treatment protocol.

**Treatment Integrity**

Procedures recommended for assessing treatment integrity were applied to this study, attempting to ensure that the (1) *delivery*, (2) *receipt*, and (3) *enactment of treatment* were carried out as planned (Lichstein, Riedel, & Grieve, 1994). Each of these procedures will be described below.

**Treatment delivery.** Procedures for monitoring 'treatment delivery' included clinician training, use of a treatment manual, and calculating a percentage of treatment fidelity.

***Clinician training.*** One clinician, the first author, conducted all of the treatment sessions. The clinician, certified as a speech-language pathologist for two years, has worked primarily with adult language, cognitive-communication, and swallowing disorders. The clinician participated in four hours of training on ILAT by Karyn Pingel, M.S., CCC-SLP. Pingel participated as a clinician in the Maher et al. (2006) study. Pingel continues to implement ILAT in her daily clinical practices. Within the four hours of training, one hour of training included information about the theoretical background of the treatment and role-play activities using the treatment card sets. The remaining three hours included observation and hands-on supervised practice using the general treatment procedures with individuals with aphasia. The procedures of ILAT in the current study were similar to those previously utilized by Pingel (Maher et al., 2006). A hierarchy of rules was utilized (i.e., moving from a single-word request with rising intonation to a sentence-level request including descriptor of the desired object). The cueing provided by Pingel during participant word retrieval errors was diverse, including (but not limited to) modeling, phonemic cues, sentence completion, semantic associations, and personalized cues, which differ from the current study. Cueing utilized in the current study included 'personalized cues' (described above) (Marshall & Freed, 2006).

***Treatment manual.*** A treatment manual, including the previously detailed procedures in a check-list format, provided the clinician with a guide for the assessment and treatment procedures and a means for monitoring compliance or delivery of the treatment.

***Delivery assessment.*** If the treatment is not implemented by the clinician as designed and as described in the treatment protocol, conclusions drawn from the results of the study may be moot, relating to a treatment that was undefined and not replicable. Other researchers would be unable to use the results in any beneficial manner or, even worse, may use the results to make false conclusions (Hinckley, 2007). For purposes of treatment integrity, throughout the treatment study, the clinician taped treatment sessions. After the study was completed a certified speech-language pathologist, who was not involved in providing the treatment program, systematically rated two randomly chosen treatment session videos (20% of all sessions) and marked each procedure on a treatment manual checklist as it occurred and noting deviations from the protocol. Point-to-point agreement averaged 94%. Minimal deviations from the protocol included: allowing a gesture to communicate without spoken language production and without clinician requesting spoken language production and not requiring the participant to repeat the entire phrase after being provided a model.

**Receipt induction.** 'Receipt induction' (i.e., the assessment of the perception and comprehension of the treatment goal by the participant) determines whether or not the participant may be influenced by the treatment in the manner which the experimenter wished (Lichstein et al., 1994). Lichstein et al., (1994) reported that poor comprehension of treatment by the participants results in an unfair test for potential outcomes of the treatment. Strategies must be in place to make sure that the treatment is comprehended (Turner, Clancy, McQuade, & Cardenas, 1990). Presenting lecture slides of treatment components has been used as another form of receipt induction (Davis, Olmsted, & Rockert, 1990).

In the present study, formal strategies for helping participants comprehend the treatment included role-play activities within a video format and lecture slides initially explaining the goal and procedures of the treatment. Informal receipt induction included simple verbal cues or reminders to use the important parts of the treatment, e.g., saying, "Use all parts of the sentence or request" or "Which one? Remember there are two different ones to choose from."

**Enactment of treatment.** Control of the 'enactment of treatment' (i.e., monitoring exposure to treatment) is another crucial component in treatment integrity (Lichstein et al., 1994) and was controlled implicitly by the nature of the turn-taking task within the treatment procedures. During treatment, the number of communicative opportunities was similar across participants due to the use of turn-taking involved in the language game; however, the number of communicative opportunities for each participant was not controlled a priori.

One common form of treatment enactment in behavioral research is the use of homework (Lichstein et al., 1994). Previous research on ILAT has indicated that additional homework may result in similar or better communicative effectiveness. Meinzer et al. (2005) compared the typical ILAT to the "ILATplus" with additional social-functional communication exercises completed at home. The researchers found that the two treatments did not differ significantly on overall outcome measures. However, for participants that completed the additional homework, scores on subtests within the assessment battery and on a measure of social-functional communication were higher than for participants that only received the typical ILAT.

Epstein & Clauss (1982) found that strategies for giving feedback or reinforcement for compliance of homework requirements are successful methods to increase homework completion. Similarly, to other researchers, such as Beeson et al. (2004) and Rosen et al., (1990), homework forms were utilized to keep track of participant compliance. Each day participants were given any picture cards/training sets in which they had already reached criterion for maintenance. The training items were printed on homework sheets (8-½" x 11" standard copy paper) for the communication partners to use while practicing the treatment at home. This served as a maintenance activity for the patient. If the participant was unable to make a request, the communication partner modeled the request and had the participant repeat the model. These instructions were discussed with the communication partner during the baseline testing phase of the study and again when the first treatment set was mastered. The communication partner and participant demonstrated understanding of the homework instructions in front of the clinician by demonstrating a few requests by the participant/modeling by the communication partner before taking the homework sheets home.

**Data Analysis**

**Research question 1.** In order to answer research question 1 (*Will each participant with nonfluent aphasia demonstrate improvements on a social-functional communication task on trained and untrained items (proximal outcomes)?*), data analyses aimed to determine if visual inspection of the multiple baseline data indicated an increase in mean level of performance during treatment/maintenance relative to baseline performance (i.e., change in *level*) of at least 20%; and to determine if participants were able to reach at least 80% accuracy in performance during training, in order to demonstrate an operationally-defined criteria for meaningful change (Kurland et al., 2012; Wambaugh, Cameron, Kalinyak-Fliszar, Nessler, & Wright, 2004).

If participants were unable to reach at least 80% accuracy in performance during training without an increase in performance of at least 20% from baseline, changes were described as *negligible*. If performance did not reach 80% accuracy during training, but performance increased by at least 20%, changes were thought to have been *partial* (Wambaugh, Cameron, Kalinyak-Fliszar, Nessler, & Wright, 2004). Effect sizes were used to describe the magnitude of changes that were thought to have been partial and meaningful changes, but were not used to describe negligible changes. As suggested by Beeson & Robey (2006), effect sizes were calculated using a variation of Cohen's (1988) *d*-statistic as calculated by Busk & Serlin (1992), using the following equation.

$d = \bar{x}A2 - \bar{x}A1 / SA1$

where $\bar{x}A1$ = mean baseline performance in percent correct

$\bar{x}A2$ = mean posttreatment/maintenance performance in percent correct

$SA1$ = standard deviation for baseline performance in percent correct

In a review of single-subject research in aphasia, Robey, Schultz, Crawford, & Sinner (1999) calculated a tentative benchmark for determining the magnitude of change for the effect size with 2.6 as *small*, 3.9 as *medium*, and 5.8 as *large*. The effect size across each training set was weighted for number of observations (i.e., number of probe sessions), resulting in the weighted average *d*-statistic for each participant (Beeson & Robey, 2006; Busk & Serlin, 1992; Cohen, 1988). The following equation was used to calculate the weighted average *d*-statistic:

(*d*-statistic for training set 1) (# of observations for training set 1) +

(*d*-statistic for training set 2) (# of observations for set 2) / (total number of observations)

The data was plotted using Microsoft Excel following procedures suggested by Dixon, Jackson, Small, Horner-King, Lik, Garcia & Rosales (2009).

**Research question 2.** In order to answer research question 2 (*Will performance by participants with nonfluent aphasia on the social-functional communication task generalize to improvements on post-treatment measures of social-functional communication and language abilities (primary outcomes)?),* changes associated with each pre to post-treatment outcomes measures were examined to estimate clinical significance. Clinical significance is "the amount of change clinicians might accept as indicating improvement" (Katz & Wertz, 1997, p. 501).

The ADP allows the calculation of standard scores (Helm-Estabrooks, 1992, 2001). Standard scores indicate how many standard deviations a score is above or below the mean for the individuals in the standardization sample for a particular test. Standard scores are obtained by subtracting the 'population' mean from an individual test score and then dividing the difference by the 'population' standard deviation, which was completed during standardization of these two assessments. An operational definition for the present study for reaching clinical significance on the ADP was a change in two standard scores. This criterion was meant to determine a participant's performance unrelated to typical variability in testing and in relation to reliability of the test.

The CADL does not define a level of change that should be associated with clinical significance (Holland et al., 1999). However, previous research in aphasia has suggested a pre- to post-treatment change of at least 10 points on the CADL to represent clinical significance (Elman & Bernstein-Ellis, 1999). Previous ILAT research has used a critical value of ±8-points (i.e., ±2 standard deviations from the mean for the BNT standardization sample) to suggest a clinically significant change in BNT performance (Kaplan et al., 1983; Maher et al., 2006).

Lomas and colleagues (1989) defined clinical significant changes on the CETI to be a change of ±12 points.

The narrative discourse tasks were examined for changes in percent correct information units (%CIU) and words per minute (WPM) with a change greater than 18%CIU and 34 WPM (or that which may not be expected with normal test-retest variability) to be operationally defined as clinical significance for the present study (Brookshire & Nicholas, 1994; Cameron, Wambaugh, & Mauszycki, 2010; Nicholas & Brookshire, 1993).

**Research question 3.** In order to answer research question 3 (*Will performance by participants with nonfluent aphasia on the social-functional communication task generalize to improvements on post-treatment measures of cognitive-communication abilities (secondary outcome)?),* changes from pre- to post-treatment cognitive-communication assessments were analyzed, as measured by the Raven's and the CLQT. Severity scores for each cognitive domain are provided for the CLQT. A change from one severity level to the next was considered a clinically significant change on the CLQT. The Raven's does not currently have normative data that suggests change levels for determining clinical significance. For purposes of this study a change of 4 raw score points out of the total 36 points (i.e., an increase of ≥10 percent) was considered clinically significant.

**Research question 4.** In order to answer research question 4 (*Will participants with nonfluent aphasia report positive perceptions associated with the ILAT program (secondary outcome)?),* both quantitative and qualitative responses were analyzed. First, survey responses, using the 5-point likert scale, were analyzed using descriptive statistics. Index means, medians, and interquartile ranges of the ordinal data were calculated for each participant. If a survey question was describing a negative experience and the participant responded by stating the negative experience was ‘to a very high degree’, the data was reverse coded to reflect that the experience was negative instead of positive. The participants’ responses to each survey question without reverse coding was provided for the reader in Appendix D.

For qualitative responses, content analyses were conducted (Berg, 2007). Overall, the interview transcripts were short secondary to participants’ nonfluent speech. First, the first author read the interview transcripts using an open coding strategy. Concrete and descriptive codes were independently deducted based on the line-by-line content from each of the participants’ transcripts (Berg, 2007). The codes were organized in relation to the open-ended questions that were asked (i.e., analytic categories) and counted for occurrence across participants. Next, these categories and exemplifying quotations from each participant were presented to another member of the research team (Dr. Dobbs). In addition, more detailed codes were inductively derived with axial coding (Berg, 2007). For example, when a more general question was asked, “Is there anything else you would like to comment? Anything I have not asked you about?” or “Is there something you liked especially well?” more than one code may have been used to address response to the same question. Codes and published literature were discussed in relation to each other (i.e., grounded categories). The findings were then discussed between the investigators until it was agreed that the perceptions of the participants’ experiences were accurately portrayed by the chosen codes and quotations. Group consensus was utilized to enhance credibility of the data analysis by limiting potential bias from any one of the researchers (Muttiah et al., 2011).

This chapter described the methods used to examine the effectiveness of the ILAT program in individuals with nonfluent aphasia. The next chapter presents the result for each of the specified research questions obtained with those methods.

## Chapter Three: Results

As stated in Chapter 1, the present study examined the effectiveness of the ILAT program in individuals with nonfluent aphasia.  This chapter has been organized in terms of describing the individual findings for each of the four participants.  First, a detailed description of participants' demographic characteristics (see also Table 2.1) and pre-treatment language abilities (see Table 3.1) has been provided.  Initials are used for participant reference, but the initials do not reflect actual identity.

Next, in order to address research question 1, participant's individual performance on proximal outcomes of probe sessions for the social-functional communication task of requesting has been presented.  The raw data for percentage of accuracy for completion of the social-functional communication task across all probe sessions has been provided in Appendix E.  Descriptive statistics for the probe session data are provided in Tables 3.2 and 3.3.  The percentage of accuracy in task completion during probes is depicted in Figures 3.1-3.4.  The figures have been organized with graph (a) representing Set 1 responses, which ILAT was applied to first; graph (b) illustrating Set 2 responses, which ILAT was applied to after training of Set 1 was completed; graph (c) depicting the 'Exposure Control Set' responses, which examined repeated exposure of untrained items; graph (d) illustrating the 'Response Generalization Set,' which examined response to untrained items probed only at baseline and posttreatment (compared to the exposure control set that was repeatedly probed); graph (e) representing the 'Control Task Set' of repeating nonwords, which provided a comparison of performance on Set 1 and 2 to an unrelated task.

Next, in order to address research question 2, the performance on all pre/post-treatment assessments has been described, including abilities on primary outcome measures of language and social-functional communication and on secondary outcome measures of cognitive-communication abilities (see Tables 3.8 and 3.9). Finally, in order to answer research question 3, the responses from the post-treatment survey on the perceptions of their experience with the ILAT program, both quantitative (see Table 3.10) and qualitative, have been described for each participant.

**1. Participant Characteristics**

The inclusion and exclusion criteria for participants have been provided in the Chapter 3. The participants in the present study ranged in age from 43 to 57 years. Three participants were classified as having Broca's aphasia and one was classified as having Mixed Nonfluent Aphasia (as classified by the ADP). Participants' level of education (in years) ranged from 12 to 16. Generally, during spoken language production participants used substantive words (e.g., nouns, main verbs) with few functor words (e.g., articles, auxiliary verbs). More detailed individual case presentations have been provided below.

**1a. Participant A.C.** A.C. was a 51-year-old, right-handed female who experienced a left hemisphere hemorrhagic stroke at the age of 44. Before her stroke, A.C. had attended college where she met her husband. They had two children and A.C. stayed home while the children were growing up. She reported that she spent most of her days cooking and cleaning, and enjoyed tailgating during football season, as her favorite leisure activity. At the time of the present study, her daughter and son were both in college and visited home occasionally. She communicated that her children are the most important thing in her life. Her husband commonly worked long hours with his career, but tried to be involved in the aphasia community in their area as much as possible. She was able to drive herself to and from sessions with assisted technology.

At seven years post-stroke, A.C. demonstrated Broca's aphasia according to the criteria of the Aphasia Diagnostic Profiles (ADP; Helm-Estabrooks, 1992), paresis of the right arm and leg. Her responses on the GDS were not indicative of further evaluation for depression; however, her mood often suggested sadness. Her spoken output was characterized by mostly circumlocutions, semantic paraphasias, gestures, and stereotyped phrases that she commonly used, such as, "long ago" and "that's right." She rarely augmented her speech with writing. She never utilized drawing. She used mostly spoken output to communicate, along with facial expressions and some gestures during informal conversation.

**1b. Participant B.J.** B.J. was a 57 year-old, left handed female who experienced a left hemisphere stroke at the age of 54 years. B.J. attended college and became a sales worker. B.J. was divorced and had two adult children. B.J. was taking antidepressants during completion of the study. Her responses on the GDS were not indicative of further evaluation for depression.

At three years' post-stroke, B.J. demonstrated Broca's aphasia according to the criteria of the ADP, paresis of the right arm and leg. Her spoken output was characterized with an abundance of nonword fillers (e.g., uh, um); over-learned expressions or words, such as, "I know," "and then," and "okay;" finger-spelling; and first-letter-self-cueing, which appeared to be effective less than 50% of the time. She rarely augmented her speech with writing or gestures.

**1c. Participant C.G.** C.G. was a 43 year-old right handed male who experienced a left hemisphere ischemic stroke at the age of 39. C.G. attended college and also became a sales worker. He was married with two young children. He had no history of depression, and results from the GDS were not indicative of further evaluation for depression. At three years' post-stroke, C.G. demonstrated Broca's aphasia according to the criteria of the Aphasia Diagnostic Profiles (ADP), and paresis of the right arm and leg. His nonfluent spoken output was characterized by agrammatism, the use of mostly substantive words, such as nouns or main verbs, with almost no use of functor words, such as pronouns, auxiliary verbs, prepositions, and articles (Helm-Estabrooks & Albert, 2004). He commonly produced phonemic paraphasias (e.g., /bot/ for /pot/). He occasionally exhibited effortful articulation for phonemes and syllable production.

**1d. Participant D.B.** D.B. was a 55 year old female who experienced a left hemisphere hemorrhagic stroke at the age of 36. D.B. graduated high school and worked for General Motors in Detroit. She attended a trade school for her career. After her stroke she moved in with her parents until about four years ago. At that time both of her parents had passed away. So she moved in with her only child, his wife, and their infant daughter. She exercised on a stationary bike daily.

At nineteen years' post-stroke, D.B. demonstrated Mixed Nonfluent aphasia according to the criteria of the ADP, paresis of the right arm and leg. Her responses on the GDS were indicative of further evaluation for depression, though her mood each day did not suggest sadness. Her spoken output was characterized by nonword fillers (e.g., um, uh) and short utterances connected by *and.* Although her classification was that of mixed nonfluent aphasia, which is typically considered more severe than Broca's aphasia in regard to auditory comprehension skills, her spoken output aligned with Broca's aphasia with the use of primarily substantive words (e.g., nouns, main verbs) with few functor words (e.g., articles, auxiliary verbs).

## 2. Pretreatment Assessment

Overall, participants performed relatively high on the word rhyme judgment (auditory task) and relatively poorly on tasks of semantic processing (e.g., word semantic association, written word to picture matching, and the Pyramid and Palm Trees Test). Participants demonstrated more semantic paraphasias and circumlocutions than phonemic paraphasias and other error types, indicating semantic impairments across participants. Next, performance on these pretreatment language processing assessments has been described for each participant.

**2a. Participant A.C.** Prior to initiation of ILAT, A.C. scored 90% accuracy on the spoken word to picture subtest (PALPA 47). She achieved 83% accuracy on the word rhyme judgment (auditory version) (PALPA 15). She demonstrated average performance on the Pyramids and Palm Trees Test (77% accuracy) and the written word to picture task (PALPA 48) (70%). She was classified by the ADP as having relatively good auditory comprehension abilities.

A.C. refused to complete PALPA 51, suggesting that the task of word semantic association was too difficult. She performed relatively poorly on the ADP task of repetition. She achieved 43% accuracy of repetition of nonwords (PALPA 8). She also performed poorly (53% accuracy) on the task of word rhyme judgment with picture selection (PALPA 14). When A.C. made an error and then was provided with a phonemic cue on the BNT, she was only able to produce the item name 58% of the time. On A.C.'s initial response for confrontational naming on the BNT, errors consisted of 24% circumlocutions, 16% semantic paraphasias, 2% phonemic paraphasias, 2% phonemic errors on a semantic paraphasia, 2% perseveration, and 55 % of errors included no response.

**2b. Participant B.J.** Prior to initiation of treatment, B.J. performed well on the spoken word to picture task (PALPA 47) (90% accuracy), the word-rhyme judgment (auditory version) task (PALPA 14) (81% accuracy), and the Pyramids and Palm Trees Test (83% accuracy). She was rated as having relatively good auditory comprehension on the ADP. B.J. was also unable to complete two of her PALPA assessments (PALPA 14 and 48) due to the increased time compared to the other three participants that it took her to complete the initial assessment battery.

B.J. was classified by the ADP as having relatively poor repetition abilities. She also performed poorly on the nonword repetition task (PALPA 8) (59% accuracy). B.J. performed poorly in response to items with high imageability on the word semantic association task (PALAP 51) (73% accuracy), but particularly poorly on low imageability items with 60% accuracy. She appeared to be relatively unresponsive to phonemic cues. When she made an error on the confrontational naming assessment (BNT) and then was provided with a phonemic cue, she was only able to produce the item name 61% of the time. B.J.'s errors on the BNT consisted of 37% semantic paraphasias, 11% phonemic paraphasias, 6% circumlocutions, and 46% no response.

**2c. Participant C.G.** Prior to treatment, C.G.'s performance on the word rhyme judgment task, with facilitation of picture selection (PALPA 15), was high at 92% accuracy. His performance on semantic processing tasks of matching written words to pictures and spoken words to pictures was relatively high at 83% (PALPA 48) and 80% (PALPA 47) respectively. He achieved 75% accuracy on the Pyramid and Palm Trees Test, an assessment of semantic processing. C.G. was rated as having relatively good auditory comprehension skills on the ADP.

C.G. performed poorly on word semantic association tasks for words of high imageability (40% accuracy) and low imageability (27%). He scored low on repetition abilities for real words at 31% accuracy on the ADP and on nonword repetition (PALPA 8) at 20% accuracy. He refused to complete the word-rhyme judgment task using picture selection (PALPA 14), indicating that he felt it was too difficult. C.G.'s responsiveness to phonemic cueing during the Boston Naming Test (BNT) was relatively poor with 30% accuracy when provided with a phonemic cue during confrontational naming. Upon presentation of the pictorial stimuli within the BNT his errors consisted of 23% semantic paraphasias, 15% phonemic paraphasias, 8% circumlocutions, 2% unintelligible/nontranscribable, and in 47% of errors he provided no responses.

**2d. Participant D.B.** Prior to initiation of treatment, D.B. performed well on the word rhyme judgment (auditory version) task (PALPA 15) at 92% accuracy. Unfortunately, D.B. missed one assessment day during the initial assessment week due to scheduling issues with her family, causing her to be unable to complete many of the PALPA pre-treatment assessments.

D.B. was classified as having relatively poor auditory comprehension and repetition on the ADP. Upon presentation of the pictorial stimuli within the BNT her errors consisted of 32% semantic paraphasias, 15% circumlocutions, 11% phonemic paraphasia, 6% stereotypy, 3% unrelated words, 3% visual perceptual, 1 % phonemic error on a semantic paraphasia, 1% perseveration, and 18% no response. Phonemic cues were only able to assist in naming incorrect items 30% of the time.

Table 3.1

*Participant Performance on Pre-treatment Language Processing Assessments*

| | Participant | | | |
|---|---|---|---|---|
| Measure | A.C. | B.J. | C.G. | D.B. |
| Aphasia Classification (ADP) | Broca's | Broca's | Broca's | Mixed NF |
| Auditory Comprehension (ADP) | RG | RG | RG | RP |
| Repetition (ADP) | 19/36 (53%) | 25/36 (69%) | 11/36 (31%) | 22/36 (61%) |
| Nonword Repetition (PALPA 8) (first administration) | 43% | 59% | 20% | 23% |
| Word Rhyme Judgment-picture selection (PALPA 14) | 21/40 (53%) | - | - | - |
| Word Rhyme Judgment-auditory version (PALPA 15) | 48/58 (83%) | 47/58 (81%) | 55/60 (92%) | 55/60 (92%) |
| Word Semantic Association (PALPA 51) | | | | |
| High Imageability | - | 11/15 (73%) | 6/15 (40%) | - |
| Low Imageability | - | 9/15 (60%) | 4/15 (27%) | - |
| Written Word to Picture (PALPA 48) | 28/40 (70%) | - | 33/40 (83%) | - |
| Spoken Word to Picture (PALPA 47) | 36/40 (90%) | 36/40 (90%) | 32/40 (80%) | - |
| Pyramids and Palm Trees Test (PPTT) | 40/52 (77%) | 43/52 (83%) | 39/52 (75%) | - |
| BNT Phonemic Cueing Responsiveness | 31/53 (58%) | 17/28 (61%) | 12/40 (30%) | 11/37 (30%) |
| Errors in spoken production in confrontational naming | Out of 58 | Out of 35 | Out of 53 | Out of 72 |
| No Response (or no response) | 55% | 46% | 47% | 18% |
| Phonemic paraphasias | 2% | 11% | 15% | 11% |
| Semantic paraphasias | 16% | 37% | 23% | 32% |
| Circumlocutions | 24% | 6% | 8% | 15% |
| Phonemic error on a semantic paraphasia | 2% | - | 6% | 1% |
| Perseveration | 2% | - | - | 1% |
| Unintelligible, nontranscribable | - | - | 2% | - |
| Other/unrelated real word | - | - | - | 3% |
| Visual perceptual | - | - | - | 3% |
| stereotypy | - | - | - | 6% |

*Note.* ADP = Aphasia Diagnostic Profiles. NF = Nonfluent. RG – relatively good. RP = relatively poor. PALPA = Psycholinguistic Assessment of Language Processing in Aphasia. Auditory Comprehension performance is based on the ADP scores used to classify aphasia types. BNT = Boston Naming Test. ADP error classification system was used to classify errors in confrontational naming on the BNT. Percentages for errors do not always add to 100% due to rounding-off.

### 3. Performance during Probe Sessions (Proximal Outcomes)

In order to address research question 1, performance during probe sessions has been provided next. Outcomes in relation to trained probes were considered proximal outcomes. The results associated with performance during probe sessions have been provided below, but first factors associated with presentation of the treatment for the present study should be discussed.

On the first and second days of treatment all participants were able to start at Level 3 with treatment Set 1. However, on the first day of treatment all participants targeted only the low frequency words and were able to target the high frequency words by the second day of treatment for treatment Set 1. On the third day of treatment B.J. and D.B. were able to move up to Level 4, while A.C. & C.G. were still only required to produce Level 3 spoken requirements. On the fourth day of treatment (through the sixth day) all participants were at Level 4 with Set 1. On the seventh day of treatment, treatment Set 2 was introduced with all participants at Level 4.

Due to experimenter error both high and low frequencies were introduced with training on Set 2. On the second training day for Set 2 participants started with the low frequency words first and once they were able to all produce the required request at Level 4 with the low frequency items, the words of a higher frequency were incorporated into the language game. The experimenter's error did not seem to influence findings by analysis of differences in response to treatment for the set for each participant compared to performance on Set 1 items that were introduced as planned.

During the maintenance phases, D.B. did not complete maintenance activities (homework) on the second and eighth day of the Set 1 maintenance phase. A.C. was unable to complete maintenance activities on the first day of the Set 1 maintenance phase due to scheduling difficulties with her spouse and her spouse had to be trained over the phone. A.C. reported her communication partner had long work hours and tried to help with maintenance activities, but was not very effective in helping secondary to his work schedule. The clinical researcher requested that A.C. only complete maintenance activities when her communication partner was available to assist. Regardless, A.C. reported at least one instance of completing maintenance activities independently.

Table 3.2

*Descriptive Statistics (for Data Presented in Figures 3.1 – 3.4 and Appendix E in % accuracy)*

| | | Participant | | | |
|---|---|---|---|---|---|
| | Descriptive Statistics | A.C. | B.J. | C.G. | D.B. |
| Set 1 | Mean *A1* | *43.5* | *59.5* | *29.8* | *52.3* |
| | Mean *A2* | *69.4* | *95.4* | *73.3* | *96.7* |
| | SD *A1* | 8 | 6.7 | 16.5 | 12.2 |
| | Mean *B* | 55.2 | 87.2 | 48.8 | 86.6 |
| Set2 | Mean *A1* | *49.1* | *64.4* | *44.2* | *61* |
| | Mean *A2* | *66* | *100* | *81* | *85.3* |
| | SD *A1* | 8.1 | 12.6 | 12.4 | 14.2 |
| | Mean *B* | 72 | 95.8 | 74 | 85 |
| Exposure Control Set | Mean *A1* | 50.6 | 71.9 | 50.7 | 69.8 |
| | SD *A1* | 10.4 | 15.3 | 14.1 | 16.4 |
| | Mean *A2* | 63.7 | 83.7 | 64.3 | 85.3 |
| Response Generalization Set | Mean *A1* | 43.5 | 52.3 | 30.3 | 47.8 |
| | SD *A1* | 6.4 | 5.1 | 20.9 | 19.8 |
| | Mean *A2* | 56.3 | 81.7 | 74.3 | 66.7 |
| Control | Mean *A1* | 43.8 | 42.5 | 29.7 | 28.8 |
| | SD A1 | 4.2 | 6.9 | 6.5 | 4.3 |
| | Mean A2 | 51.5 | 42 | 33.3 | 42.3 |

*Note*. *A1* = pre-treatment phase. *A2* = maintenance phase. *B* = treatment phase. *SD* = standard deviation. ES = exposure control set was during each probe assessment but not used during treatment.GS = response generalization set was presented only during baseline and post-treatment testing session. Control = a control task of repeating nonwords to provide a comparison of performance on Set 1 and 2 to an unrelated task.

Table 3.3

*Summary of Participants' Responses to Treatment*

| | Participant | | | |
|---|---|---|---|---|
| | A.C. | B.J. | C.G. | D.B. |
| Change in performance from A1 to A2 (≥20%) | | | | |
| Set 1 | Yes (25.9%) | Yes (35.9%) | Yes (43.5%) | Yes (44.4%) |
| Set 2 | No (16.9 %) | Yes (35.6%) | Yes (36.8%) | Yes (24.3%) |
| ES | No (13.1%) | No (11.8%)* | No (13.6%)* | No (15.5%)* |
| GS | No (12.8%) | Yes (29.4%) | Yes (44%) | No (18.9%) |
| Control | No (7.7%) | No (-9.5%) | No (3.6 %) | No (13.5%) |
| Criteria met of reaching 80% accuracy for Set 1&2 | No | Yes | No | Yes |
| Treatment effect size (d-statistic) | 3.2** | 4.2 | 2.8 | 2.6 |
| Magnitude of effect | Small | Medium | Small | Small |

*Note.* ES = exposure control set was during each probe assessment but not used during treatment, GS = response generalization set was presented only during baseline and post-treatment testing session. Control = a control task of repeating nonwords to provide a comparison of performance on Set 1 and 2 to an unrelated task. *When the performance during the true baseline compared to A2 indicated a clinically significance exists. Magnitude of effect size = 2.6 as small, 3.9 as medium, and 5.8 as large (Robey, 1999). The treatment effect size provided is the weighted average effect size for the entire ILAT program. **Negligible changes were associated with performance on Set 2 items. Therefore, the effect size explains the magnitude o f change during training for only Set 1 items.

**3a. Participant A.C.** As seen in Figure 3.1 (a), prior to treatment, A.C.'s responses on the social-functional communication task for Set 1 ranged between 38 and 55 percent accuracy, with an average of 43.5 percent correct during the baseline phase. The average percent correct was slightly larger (45.3%) during the last three probe sessions during the true baseline. Improvements in accuracy on Set 1 items were observed after ILAT was applied. A.C. did not reach criteria of 80% accuracy during the treatment phase with Set 1, averaging 55.2. However, her performance reached 70 percent accuracy during the final probe sessions. During the maintenance phase, she maintained her performance for Set 1, with an average of 69.4 (25.9% increase from baseline). She demonstrated only partial gains in performance by improving her level of accuracy on the social-functional communication task by at least 20% without reaching criteria of 80% accuracy during training (Wambaugh, Cameron, Kalinyak-Fliszar, Nessler, & Wright, 2004). The effect size was calculated using the *d*-statistic in order to examine the magnitude of change from pretreatment to treatment/posttreatment. The calculated *d*-statistic was 3.2, indicating a small effect (Table 3.4).

As seen in Figure 3.1 (b), responses for Set 2 during the true and extended baseline ranged between 40 and 60 percent accuracy. Responses in the baseline phase averaged 49.1. Performance was slightly lower during the last three probe sessions during the true baseline (47.7 percent correct). Similarly for Set 1, during the treatment phase for Set 2, A.C. did not meet criteria. Her performance during training for Set 2 ranged between 68 and 75 percent accuracy, with an average of 72 percent accuracy. During the maintenance phase, performance on the social-functional communication task for Set 2 ranged from 53-80 percent accuracy, with a decline noted in the last two probe sessions of the maintenance phase. Performance during the maintenance phases averaged 66 percent accuracy (16.9% increase from baseline).

The criteria for demonstrating a meaningful change of performance from pretreatment to posttreatment (≥20% increase) and the criteria of 80% accuracy in performance was not met for Set 2, demonstrating negligible changes (Kurland et al., 2012; Wambaugh, Cameron, Kalinyak-Fliszar, Nessler, & Wright, 2004). The *d*-statistic for Set 2 and across Sets 1 and 2 has not been provided in the summary table for all participants' response to ILAT (Table 3.3). However, the *d*-statistic for Set 2 has been provided here for a comparison of the individual's performance across the training program. The calculated *d*-statistic was 2.1, indicating no effect for Set 2. When the measures of the magnitude of change from pretreatment to posttreatment were averaged and weighted for number of observations (or sessions per phase) in order to calculate the weighted average *d*-statistic for the overall ILAT effect for A.C. (on both Set 1 and Set 2), the *d*-statistic was 2.6, indicating a small effect (Table 3.4).

Performance on untrained sets may relate more to primary outcomes of social-functional communication because improvements on untrained sets may suggest generalization of trained skills to untrained skills. As illustrated in Figure 3.1 (c), a small improvement in accuracy in completing the social-functional communication task was noted during the exposure control set probe sessions, an untrained set. The increase was similar to responses to Set 2 items before training was applied, and performance on these items exposed during probe sessions did not parallel responding to trained items (13.1% increase). Responses on the exposure control set from baseline until the end of the second treatment phase averaged 50.6 percent correct (SD = 10.4). During the last three probes of the true baseline, accuracy levels for the exposure control set ranged from 38 to 53, averaging 46.3 percent correct. During the last three probes of the maintenance phase for Set 2, responses on the exposure control set averaged 63.7 percent correct

(13.1% increase). According to study criteria, this small increase does not indicate a clinically significant change.

As seen in Figure 3.1 (d), for the response generalization set, another untrained set, accuracy levels during the last three probes of the true baseline ranged from 38 to 50, with an average of 43.5 percent correct (SD = 6.4). In the final three probes of the maintenance phase for the second treatment set, accuracy levels for the response generalization set ranged from 38 to 63, with an average of 56.3, indicating a small increase from baseline of 12.8 percent. According to study criteria, this small increase does not indicate a clinically significant change.

As seen in Figure 3.1 (e), negligible changes in level of accuracy were noted in response to the control task from baseline to termination of treatment and maintenance phases. During baseline and across treatment phases, performance on the control task averaged 44.5. During the true baseline, performance on the control task ranged from 40 to 43, with an average of 43.8 percent correct. In the final two probes of the maintenance phase for the second treatment set, accuracy levels for the control task ranged from 50 to 53, with an average of 51.5 (7.7% increase).

Table 3.4

*A.C.'s Analysis of Data for Calculating Effect Sizes*

| | Set 1 | Set 2 | Sum |
|---|---|---|---|
| Mean *A*1 | *43.5* | *49.1* | __ |
| Mean *A*2 | *69.4* | 66 | __ |
| Mean *A*2 – Mean A1 | 25.9 | 16.9 | __ |
| SD *A*1 | 8 | 8.1 | __ |
| *d* (Mean *A*2 – Mean A1/ SD *A*1) | **3.2** | **2.1** | __ |
| # observations *A*1 + *A*2 | 4+7= 11 | 9 + 3 = 12 | 23 |
| Weighted *d* (*d* × # observations *A*1 + *A*2) | 35.2 | 25.2 | 60.4 |
| Weighted *d* for all data (weighted *d/ total* # observations for sets 1 & 2) | __ | __ | **2.6** |

*Note.* The data analyzed was provided in Table 3.2. The *d*-statistic, indexing change in the level of performance from before versus after initiation of treatment, was provided for each set and weighted for number of observations to index the level of change during the entire treatment-program; phases *A*1 = pre-treatment phase; *A*2 = post-treatment phase; *SD* = standard deviation. Magnitude of effect size = 2.6 as small, 3.9 as medium, and 5.8 as large (Robey, 1999)

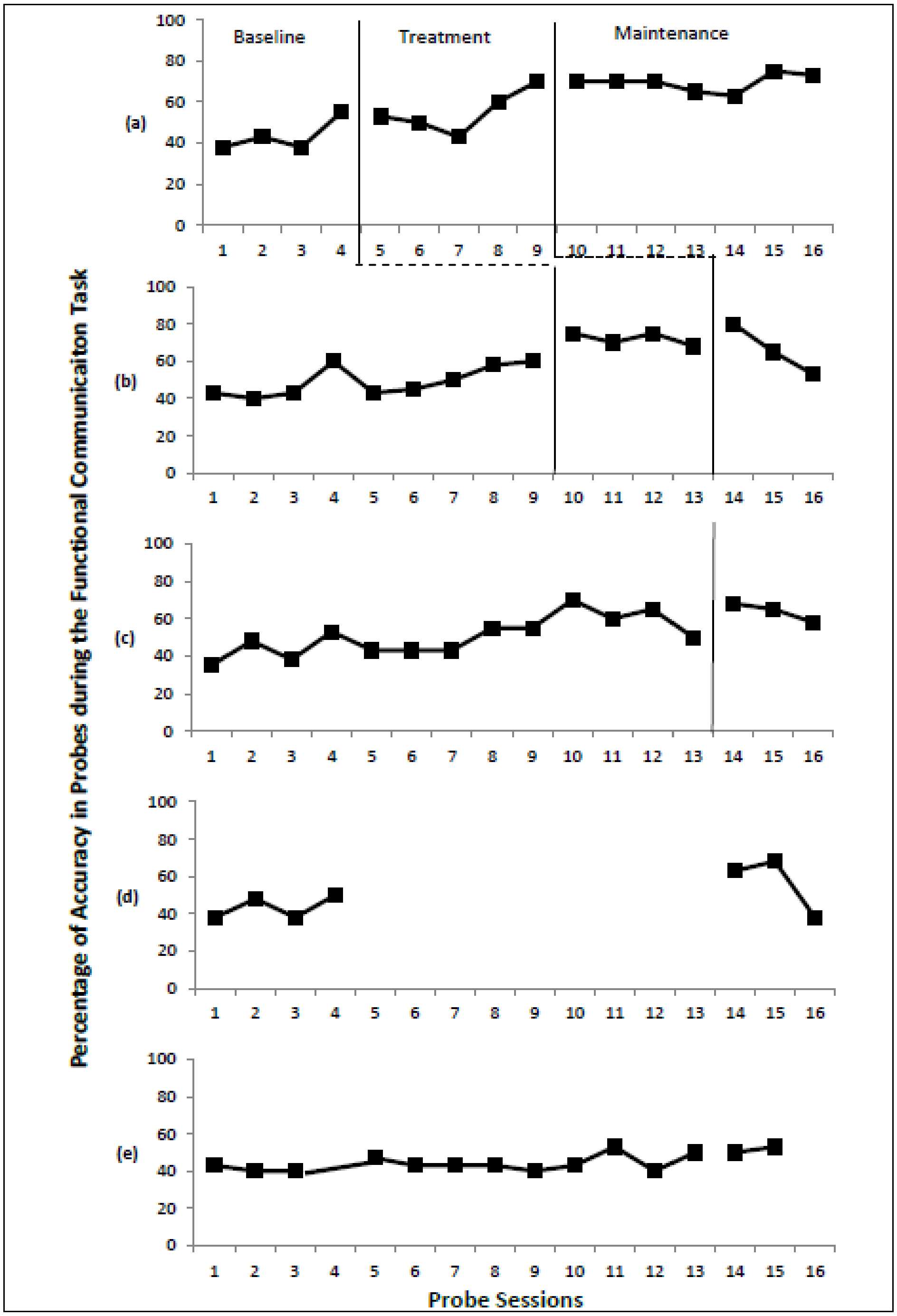


*Figure 3.1.* Participant A.C.'s response to treatment on probe sessions.

*Note.* Percentage of accuracy in probes during the social-functional communication task: (a) set 1, (b) set 2, (c) exposure control set, (d) response generalization set, (e) control set.

**3b. Participant B.J.** Prior to treatment, responses on the social-functional communication task for Set 1 ranged between 50 and 65 percent accuracy, averaging 59.5 percent correct during the baseline phase (Figure 3.2 (a)). Performance was lower during the last three probe sessions of the true baseline, averaging 43.7 percent correct. Improvements in accuracy on Set 1 items were observed after ILAT was applied. B.J. was not able to reach criteria of 80% accuracy during the treatment phase for Set 1, averaging 87.2. During the maintenance phase, she maintained her performance for Set 1, with an average of 95.4 (35.9% increase from baseline). The effect size was calculated using the *d*-statistic in order to examine the magnitude of change from pretreatment to treatment/posttreatment. The calculated *d*-statistic was 4.5, indicating a medium effect (Table 3.5).

As seen in Figure 3.2 (b), responses for Set 2 during the true and extended baseline ranged between 45 and 80 percent accuracy, with the last three probes ranging between 75 and 80. Responses in the baseline phase averaged 64.4. Performance was much lower during the last three probe sessions during the true baseline, averaging 58.7 percent correct. Her performance during training for Set 2 ranged between 83 and 100 percent accuracy, with an average of 95.8 percent accuracy. During the maintenance phase for Set 2, B.J. maintained 100 percent accuracy (35.6% increase). The calculated *d*-statistic was 3.9, indicating a medium effect. These measures of the magnitude of change from pretreatment to posttreatment have been averaged and weighted for number of observations (or sessions per phase) in order to calculate the weighted average *d* statistic for the ILAT effect for B.J., which was 4.2, indicating an overall medium effect.

As illustrated in Figure 3.2 (c), an improvement in accuracy was noted on the exposure control set during training of Set 1, which continued from baseline until the end of the second treatment phase (Mean = 71.9, SD = 15.3). During the last three probes of the true baseline, B.J.'s accuracy levels for the exposure control set ranged from 53 to 68, averaging 62 percent correct. During the last three probes of the maintenance phase for Set 2, responses on the exposure control set averaged 83.7 percent correct (11.8% increase). According to study criteria, this small increase does not indicate a clinically significant change. It is interesting to note that change in performance from the true baseline demonstrated a clinically significant change (21.7 percent increase).

As seen in Figure 3.2 (d), B.J's accuracy level during the baseline and across treatment phases averaged 52.3. During the last three probes of the true baseline, responses on the response generalization set ranged from 35 to 48, averaging 40.3 percent correct. In the final three probes of the maintenance phase for the second treatment set, accuracy levels for the response generalization set ranged from 75 to 90, with an average of 81.7, indicating an increase from baseline greater than 20% (29.4 percent correct) and suggesting generalization of skills from trained items to untrained items.

As seen in Figure 3.2 (e), negligible changes in B.J.'s level of accuracy were noted in response to the control task from baseline to termination of treatment and maintenance phases. During baseline, performance ranged from 33 to 59, with an average of 42.5 percent correct. During the last three probes of the true baseline performance averaged 47.7 percent correct. In the final three probes of the maintenance phase for the second treatment set, accuracy levels for the control task ranged from 40 to 43, with an average of 42 (-0.50% decrease).

Table 3.5

*B.J.'s Analysis of Data for Calculating Effect Sizes*

| | Set 1 | Set 2 | Sum |
|---|---|---|---|
| Mean *A*1 | 59.5 | 64.4 | __ |
| Mean *A*2 | 95.4 | 100 | __ |
| Mean *A*2 – Mean A1 | 35.9 | 35.6 | __ |
| SD *A*1 | 8 | 9.1 | __ |
| *d* (Mean *A*2 – Mean A1/ SD *A*1) | **4.5** | **3.9** | __ |
| # observations *A*1 + *A*2 | 4+7 = 11 | 9+ 3 = 12 | 23 |
| Weighted *d* (*d* × # observations *A*1 + *A*2) | 49.5 | 46.8 | 96.3 |
| Weighted *d* for all data (weighted *d*/ *total* # observations for sets 1 & 2) | __ | __ | **4.2** |

*Note.* The data analyzed was provided in Table 3.2. The *d*-statistic, indexing change in the level of performance from before versus after initiation of treatment, was provided for each set and weighted for number of observations to index the level of change during the entire treatment-program; phases *A*1 = pre-treatment phase; *A*2 = post-treatment phase; *SD* = standard deviation. Magnitude of effect size = 2.6 as small, 3.9 as medium, and 5.8 as large (Robey, 1999).

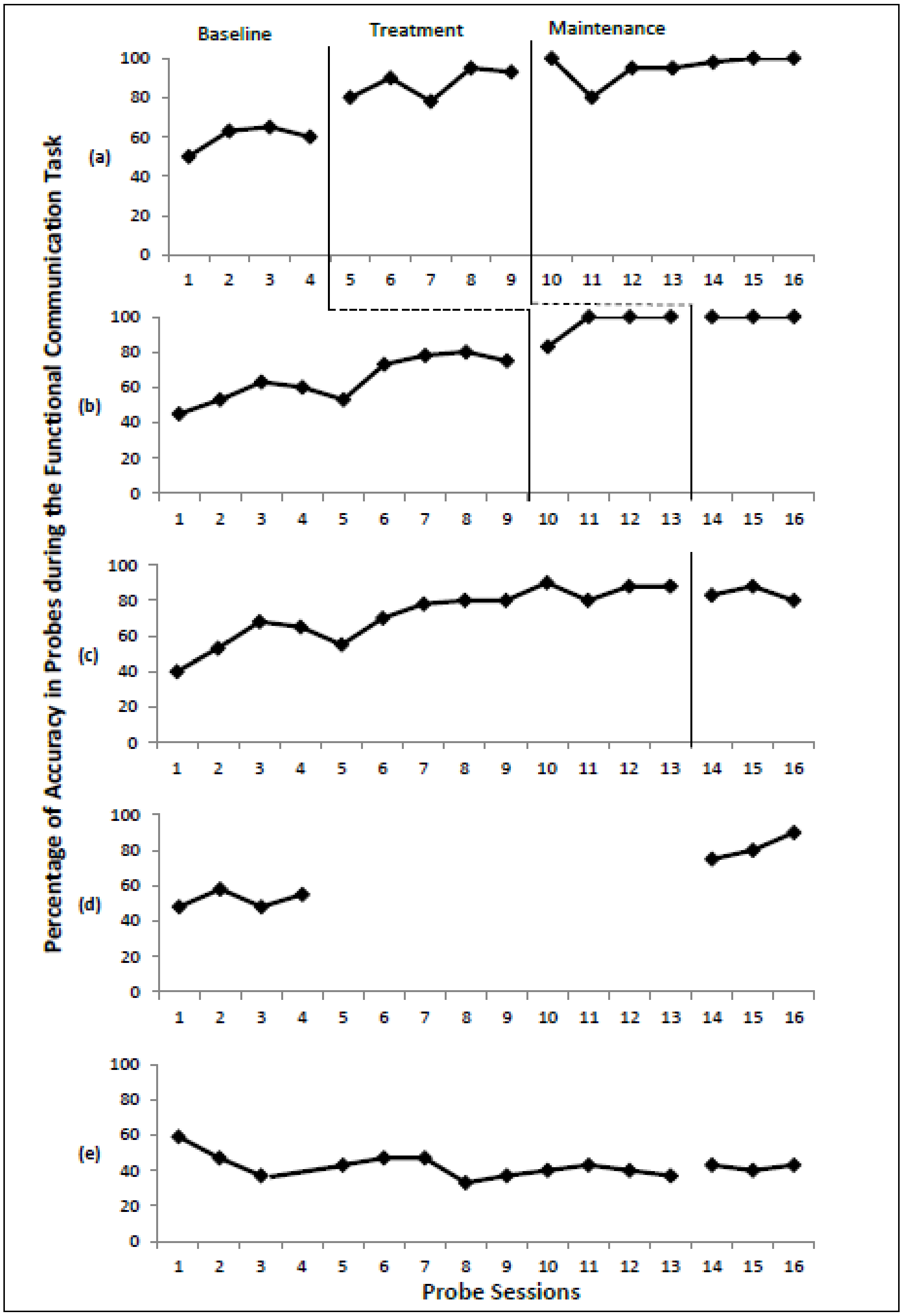


*Figure 3.2.* Participant B.J.'s response to treatment on probe sessions.

*Note.* Percentage of accuracy in probes during the social-functional communication task: (a) set 1, (b) set 2, (c) exposure control set, (d) response generalization set, (e) control set.

**3c. Participant C.G.** C.G.'s performance on the social-functional communication task for Set 1 ranged between 8 and 48 percent accuracy, with an average of 29.8 percent correct (Figure 3.3 (a)). During the last three probes in the true baseline, performance was higher at 37 percent correct. Improvements in accuracy on Set 1 items were observed after ILAT was applied. C.G. did not reach criteria of 80% accuracy during the training with Set 1. His average percent accuracy was 48.8. However, his performance reached a high of 75 percent accuracy during the final probe session. During the maintenance phase, he maintained his performance for Set 1, with an average of 73.3 (43.5% increase). The effect size was calculated using the *d*-statistic in order to examine the magnitude of change from pretreatment to treatment/posttreatment. The calculated *d*-statistic was 2.6, indicating a small effect (Table 3.6).

As seen in Figure 3.3 (b), C.G.'s responses for Set 2 during the true and extended baseline ranged between 18 and 60 percent accuracy, with the last three probes ranging between 48 and 60. Responses in the baseline phase averaged 44.2. During the last three probes of the true baseline, performance averaged 47.7 percent correct. During training for Set 2, C.G. did meet criteria. His performance during training for Set 2 ranged between 65 and 80 percent accuracy, with an average of 74 percent accuracy. During the maintenance phase, he maintained his increase in performance for Set 2, ranging from 75-85 percent accuracy, with an average of 81 percent accuracy (36.8% increase).

Although C.G. did not demonstrate 80% accuracy in performance during training for both sets, he demonstrated a change of greater than 20% from pretreatment to posttreatment and maintenance probe performance, indicating at least partial (re)learning of completing the functional task of the verbal request, compared to the negligible changes demonstrated by A.C. during training of Set 2 (Wambaugh, Cameron, Kalinyak-Fliszar, Nessler, & Wright, 2004). The calculated *d*-statistic was 3.0, indicating a small effect. These measures of the magnitude of change from pretreatment to posttreatment have been averaged and weighted for number of observations (or sessions per phase) in order to calculate the weighted average *d*-statistic for the ILAT effect for C.G. The *d*-statistic was 2.8, indicating an overall small effect.

As illustrated in Figure 3.3 (c), improvements in accuracy was noted for the exposure control set during training of Set 1, which continued from baseline until the end of the second treatment phase (Mean = 50.7, SD = 14.1). During the last three probes of the true baseline, accuracy levels for the exposure control set ranged from 30 to 53, averaging 42 percent correct. During the last three probes of the maintenance phase for the Set 2, response on the exposure control set averaged 64.3 percent correct (13.6% increase). When change was measured from the true baseline to posttreatment performance a clinically significant change existed (22.3% increase).

As seen in Figure 3.3 (d), accuracy levels for the response generalization set during baseline averaged 30.3. During the last three probes of the true baseline, accuracy for percent correct ranged from 35 to 48, averaging 40.3 percent correct. In the final three probes of the maintenance phase for the second treatment set, accuracy levels for the response generalization set ranged from 65 to 90, with an average of 74.3, indicating an increase from baseline greater than 20% (44% increase) and suggesting generalization of skills from trained items to untrained items.

Table 3.6

*C.G.'s Analysis of Data for Calculating Effect Sizes*

| | Set 1 | Set 2 | Sum |
|---|---|---|---|
| Mean *A*1 | 29.8 | 44.2 | — |
| Mean *A*2 | 73.3 | 81 | — |
| Mean *A*2 – Mean A1 | 43.5 | 36.8 | — |
| SD *A*1 | 16.5 | 12.4 | — |
| *d* (Mean *A*2 – Mean A1/ SD *A*1) | **2.6** | **3.0** | — |
| # observations *A*1 + *A*2 | 4+7 = 11 | 9+ 3 = 12 | 23 |
| Weighted *d* (*d* × # observations *A*1 + *A*2) | 28.6 | 36 | 64.6 |
| Weighted *d* for all data (weighted *d/ total* # observations for sets 1 & 2) | — | — | **2.8** |

*Note.* The data analyzed was provided in Table 3.2. The *d*-statistic, indexing change in the level of performance from before versus after initiation of treatment, was provided for each set and weighted for number of observations to index the level of change during the entire treatment-program; phases *A*1 = pre-treatment phase; *A*2 = post-treatment phase; *SD* = standard deviation. Magnitude of effect size = 2.6 as small, 3.9 as medium, and 5.8 as large (Robey, 1999).

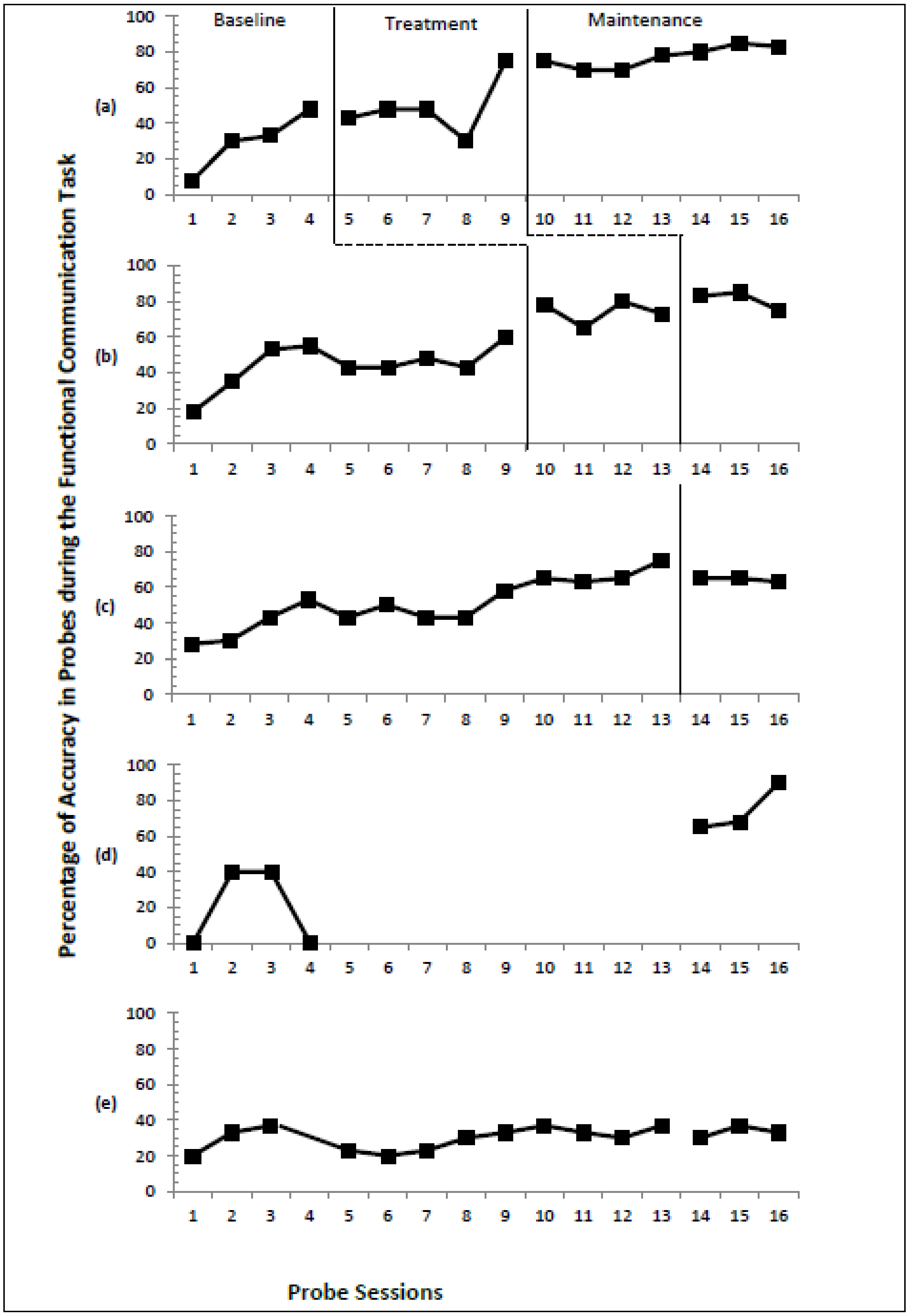


*Figure 3.3*. Participant C.G.'s response to treatment on probe sessions.

*Note.* Percentage of accuracy in probes during the social-functional communication task: (a) set 1, (b) set 2, (c) exposure control set, (d) response generalization set, (e) control set.

As seen in Figure 3.3 (e), negligible changes in level of accuracy were noted in response to the control task from baseline to termination of treatment and maintenance phases. During baseline, performance ranged from 20 to 37, with an average of 29.7 percent correct. During last three probe sessions in the true baseline, performance averaged 45 percent correct. In the final three probes of the maintenance phase for the second treatment set, accuracy levels for the control task ranged from 30 to 37, with an average of 33.3 (3.6% increase).

**3d. Participant D.B.** As seen in Figure 3.4 (a), D.B.'s responses on the social-functional communication task during the baseline phase for Set 1 ranged between 35 and 63 percent accuracy, averaging 52.3 percent correct. During the last three probes of the true baseline, her performance averaged 58 percent correct. Improvements in accuracy on Set 1 items were observed after ILAT was applied. D.B. was able to reach criteria of at least 80% accuracy during the treatment phase with Set 1, averaging 86.6. During the maintenance phase, she maintained her performance for Set 1, with an average of 96.7 (44.4% increase from baseline). The effect size was calculated using the *d*-statistic in order to examine the magnitude of change from pretreatment to treatment/posttreatment. The calculated *d*-statistic was 3.6, indicating a small effect (Table 3.7).

As seen in Figure 3.4 (b), responses for Set 2 during the true and extended baseline ranged between 33 and 80 percent accuracy, with the last three probes ranging between 70 and 80. Responses in the baseline phase averaged 61 percent correct. During the last three probes of the true baseline, performance was slightly lower, averaging 56 percent correct. D.B. missed the one day of treatment (and one probe session) during training on Set 2, secondary to a seizure. She returned to treatment on the following day. D.B. still managed to meet criteria for training Set 2. Her performance during training for Set 2 ranged between 80 and 90 percent accuracy, with an average of 85 percent accuracy. During the maintenance phase, she maintained her increase in performance for Set 2, ranging from 83-90 percent accuracy, with an average of 85.3 percent accuracy (24.3% increase). The calculated *d*-statistic was 1.7, indicating no effect. However, the measures of the magnitude of change from pretreatment to posttreatment have been averaged and weighted for number of observations (or sessions per phase) in order to calculate the weighted average *d*-statistic for the ILAT effect for D.B., which was 2.6, indicating an overall small effect.

As illustrated in Figure 3.4 (c), an improvement in accuracy was noted for the exposure control set during training of Set 1, which continued from baseline until the end of the second treatment phase (Mean = 69.8, SD = 16.4). During the last three probes of the true baseline, accuracy levels for the exposure control set ranged from 53 to 63, averaging 58 percent correct. In the final three probes of the maintenance phase for the second treatment set, accuracy levels for the exposure control set averaged 85.3 percent correct (15.5% increase). When change in performance from the true baseline to the maintenance phase was considered an increase from baseline greater than 20% existed (27.3% increase) and suggested generalization of skills from trained items to untrained items.

As seen in Figure 3.4 (d), accuracy levels during baseline averaged 47.8 percent correct. Accuracy levels for the response generalization set during the last three probes of the true baseline ranged from 23 to 37, with an average of 30 percent correct. In the final three probes of the maintenance phase for the second treatment set, accuracy levels for the response generalization set ranged from 55 to 80, with an average of 66.7 (18.9 percent increase). Similarly to performance on the exposure control set, when change in performance from the true baseline to the maintenance phase was considered for the response generalization set an increase from baseline greater than 20% existed (36.7% increase) and suggested generalization of skills from trained items to untrained items.

As seen in Figure 3.4 (e), small changes in level of accuracy were noted in response to the control task from baseline to termination of treatment and maintenance phases. During baseline, performance on the control task averaged 28.8 percent correct. During the true baseline, performance on the control task ranged from 23 to37, with an average of 30 percent correct. In the final three probes of the maintenance phase for the second treatment set, accuracy levels for the control task ranged from 37 to 47, with an average of 42.3 (13.5% increase).

In summary, results of the present study revealed a modest increase on proximal outcomes measures in individuals with nonfluent aphasia. Performance was measured by changes in mean level performance during treatment/maintenance relative to baseline (i.e., change in *level*) on the social-functional communication task of a verbal request. Three out of four participants (i.e., B.J., C.G., and D.B.) met a predetermined criterion for demonstrating meaningful change in performance (a change of ≥20%) for both training sets. Effect sizes generally suggested a small magnitude of change from before to after completion of the ILAT program across participants. However, one participant (B.J.) demonstrated a medium effect.

Some generalization of improvements on the response generalization set and the exposure control set were expected, because of existing overlapping required to correctly complete the social-functional communication task for these items and for the trained items. If participants would have showed improvements on the social-functional communication task for the exposure control set and not for the response generalization set, these findings may have suggested that repeated exposure alone influenced performance.

Table 3.7

*D.B.'s Analysis of Data for Calculating Effect Sizes*

| | Set 1 | Set 2 | Sum |
|---|---|---|---|
| Mean *A*1 | 52.3 | 61 | — |
| Mean *A*2 | 96.7 | 85.3 | — |
| Mean *A*2 – Mean A1 | 44.4 | 24.3 | — |
| SD *A*1 | 12.2 | 14.2 | — |
| *d* (Mean *A*2 – Mean A1/ SD *A*1) | **3.6** | **1.7** | — |
| # observations *A*1 + *A*2 | 4+6 = 10 | 9+ 3 = 12 | 22 |
| Weighted *d* (*d* × # observations *A*1 + *A*2) | 36 | 20.4 | 56.4 |
| Weighted *d* for all data (weighted *d*/ *total* # observations for sets 1 & 2) | — | — | **2.6** |

*Note.* The data analyzed was provided in Table 3.2. The *d*-statistic, indexing change in the level of performance from before versus after initiation of treatment, was provided for each set and weighted for number of observations to index the level of change during the entire ILAT program; phases *A*1 = pre-treatment phase; *A*2 = post-treatment phase; *SD* = standard deviation. Magnitude of effect size = 2.6 as small, 3.9 as medium, and 5.8 as large (Robey, 1999).

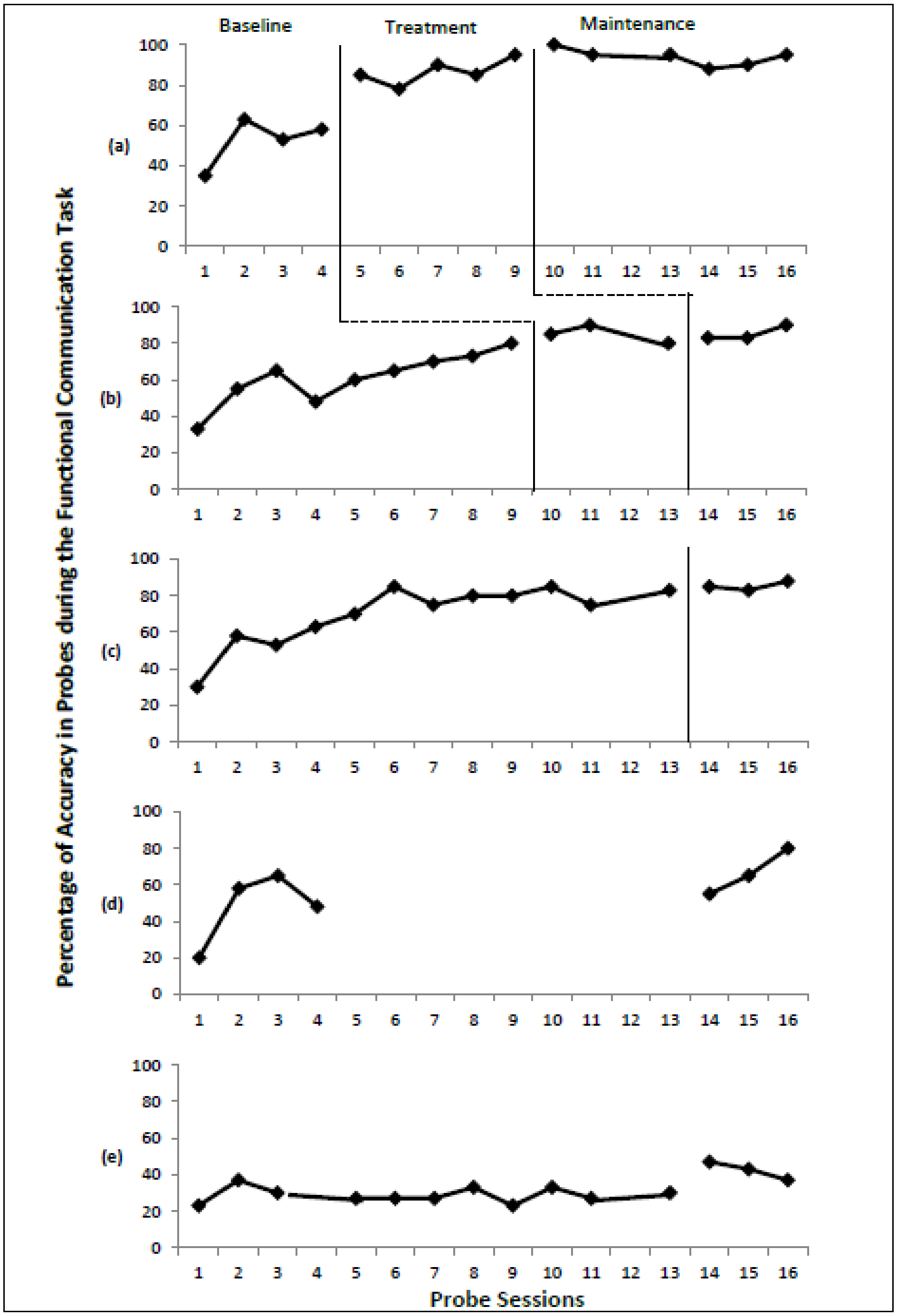


*Figure 3.4.* Participant D.B.'s response to treatment on probe sessions.

*Note.* Percentage of accuracy in probes during the social-functional communication task: (a) set 1, (b) set 2, (c) exposure control set, (d) response generalization set, (e) control set.

Generalization was noted for both sets for two participants (B.J. and C.G.), when changes in performance from posttreatment for the exposure control sets and the response generalization sets were compared to the true baseline (i.e., before treatment was ever applied to a training set). For one participant, D.B., only the exposure control set demonstrated clinically significant changes, according to the criteria of ≥20% change. However, D.B.'s performance on response generalization items reached 18.9%, only 1.1 percentage points from the criteria for demonstrating meaningful change. It is important to note, that these findings could suggest that the independent variable was not adequately controlled, because the effect was seen even when treatment was not being applied. These finding may weaken internal validity of the experimental design, which has been suggested in the discussion section. However, the replication of the effect across three of the four participants and the stability of participants' performance on the control task strengthens the present findings.

**4. Performance on Posttreatment Assessment (Primary and Secondary Outcome Measures)**

Next, in order to address research questions 2 and 3, performance on posttreatment assessments has been provided for primary and secondary outcome measures. Primary outcome measures included assessments of language and social-functional communication. Secondary outcome measures included assessments of cognitive-communication and participant perceptions. Participant perceptions have been provided in a later section.

**4a. Participant A.C.** A.C.'s performance on posttreatment assessments indicated clinically significant improvements (≥12) on alternative communication (as measured by the ADP) and on the Communicative Effectiveness Index. On the CADL, another assessment of social-functional communication skills, A.C. demonstrated clinically significant changes (≥ 10) in performance on the post-treatment assessment overall score.

The CADL differs from the social-functional communication task of a verbal request that was used during probe sessions, because the CADL allows for the use of multiple modalities (i.e., verbal, gestural, pointing, writing, drawing). CADL performance was examined on items containing overlapping elements to the social-functional communication task of a verbal request used during probe sessions. Since the ILAT program required a verbal request, generalization of the use of the verbal modality for communicating a message was expected to be observed during posttreatment CADL performance. CADL items that appeared to have the most overlapping elements in task requirements to elements within the ILAT task requirements (i.e., near transfer) included CADL item 44, which required participants to look at a picture of a house on fire and ask for help; CADL item 45, which required participants to describe a picture and relate two parts within the picture; and CADL item 36, which required participants to look at a picture of a store and ask for help finding a specific item. Other CADL items that appeared to have overlapping elements in task requirements, but less overlapping elements (i.e., further transfer), included CADL item 8, which required participants to view a menu and order lunch; CADL item 11, which required participants to indicate that they were cold and wanted assistance to get warmer; and CADL item 23, which required participants to make a clarification in response to an incorrect assumption about them.

After completing ILAT, a treatment requiring the use of the verbal modality, A.C. demonstrated one example of changing the modality used on posttreatment CADL item 36 to a verbal response (from a verbal + gestural response). However, the change in modalities used did not change her score for the item. A.C.'s post-treatment responses on the other CADL items listed above did not seem to reflect an increased (or decreased) use of verbal responses.

Unexpectedly, A.C. demonstrated significant declines (≥2 standard scores) in overall aphasia severity and auditory comprehension skills on the ADP. She also demonstrated declines on cognitive-communicative abilities, including attention and executive functions, as measured by the CLQT, suggesting a mild-moderate impairment. A.C. did not demonstrate noteworthy changes on the discourse production measures.

**4b. Participant B.J.** B.J. demonstrated clinically significant improvements in cognitive-communication abilities of attention skills (as measured by the CLQT), changing severity ratings from mild impairments to within normal limits. B.J. demonstrated clinically significant decline on alternative communication as measured by the ADP. On another measure of social-functional communication, the CADL, B.J.'s posttreatment performance did not suggest a clinically significant change from pretreatment. On item analysis of post-treatment CADL performance, similarly to A.C., B.J. demonstrated one example of changing the modality used on posttreatment CADL performance with the use of solely a verbal response in replace of a verbal + gestural response on CADL item 36. The change in modalities used improved her score for the item. B.J.'s post-treatment responses on the other CADL items analyzed (listed above) did not seem to reflect an increased (or decreased) use of verbal responses. Marked changes (≥18 %CIUs) from pretreatment to posttreatment were demonstrated in B.J.'s percent correct information units in discourse production with an improvement of 32% on the cookie theft description and a 36% on the Cinderella narrative.

**4c. Participant C.G.** On posttreatment assessment, C.G. demonstrated a clinically significant improvement in confrontational naming abilities on the BNT (≥8). Unexpectedly, C.G. demonstrated a clinically significant decline (≥2 standard scores) in test performance on the

ADP for aphasia severity and auditory comprehension skills. He also demonstrated a decline in executive functions, as measured by the CLQT, suggesting a mild impairment at posttreatment.

C.G. demonstrated only a slight improvement on the CADL, which did not suggest clinical significance. On item analysis of post-treatment CADL performance, C.G demonstrated two examples of changing the modality used on posttreatment CADL performance with the use verbal + gestural response to replace solely a verbal request on two CADL items (items 36 and 44). The change in modalities used did not change his score for the item. C.G.'s post-treatment responses on the other CADL items analyzed (listed above) did not seem to reflect an increased (or decreased) use of verbal responses.

On the two discourse measures (the cookie theft picture description and the Cinderella narrative), C.G.'s change in pretreatment to posttreatment performance demonstrated a marked improvement (≥18%) of 24% and 25% correct information units, respectively. However, his total number of words and sample time were low and therefore would have impacted percentage of CIUs.

**4d. Participant D.B.** D.B. demonstrated clinically significant improvements in overall aphasia severity (≥2 standard scores). Unfortunately due to scheduling issues she was unable to complete the CLQT. Therefore, whether or not changes would have occurred on this measure of cognitive-communication abilities is unknown. D.B.'s post-treatment responses on CADL items (listed above), which had overlapping elements with the social-functional communication task used during probe sessions, did not seem to reflect an increased (or decreased) use of verbal responses. Her performance on the discourse measures remained relatively stable.

In summary, improvements in trained skills appeared to generalize to some untrained skills. For language outcome measures, one participant (D.B.) demonstrated improvements on overall level of aphasia severity (classified as less severe). Only one participant (C.G.) demonstrated improvements on posttreatment confrontational naming skills on the BNT, an assessment area previously predicted to improve after ILAT (Kurland et al., 2012). Cognitive-communication abilities of attention skills (CLQT) improved for one participant (B.J.).

For social-functional communication, two participants (B.J. and C.G.) demonstrated improvements in percent of correct information units provided in the discourse production tasks. One participant (A.C.) demonstrated improvements on posttreatment performance on the assessment of communication ratings (the CETI).

On the CADL, another outcome measure of social-functional communication, only one participant (A.C.) demonstrated clinically significant changes. The other participants demonstrated improvements on the CADL at posttreatment, which did not suggest clinical significance. When CADL items were analyzed for use of language modalities (e.g., gestures, speech, writing), one participant (B.J.) added the use of the gestural modality post-treatment, to a pre-treatment verbal-only response. Another participant (A.C.) did just the opposite. She provided an example of changing a verbal-plus-gestural pretreatment response to a verbal-only response at posttreatment. Another participant (C.G.) changed his response on two CADL pretreatment responses, from using a verbal-plus-gestural response to using a verbal-only response.

Unexpectedly, declines in participants' posttreatment assessment were demonstrated as well. Two participants (A.C. and C.G.) demonstrated a decline in posttreatment performance on aphasia severity and auditory comprehension (on the ADP) and cognitive-communication skills (on the CLQT). One participant (B.J.) demonstrated posttreatment improvements on cognitive-communication abilities (on the CLQT) without improvements on language abilities (as

Table 3.8

*Participants' Performance on Pre- and Post-treatment Outcome Measures*

| Measure | Participants | | | |
|---|---|---|---|---|
| | A.C. | B.J. | C.G. | D.B. |
| ADP (standard score; percentile) | | | | |
| Aphasia Severity | | | | |
| Pre | 97; 42nd | 102; 55th | 98; 45th | 92; 30th |
| Post | 92[c]; 30th | 101; 53rd | 93[c]; 32nd | 94[c]; 35th |
| Lexical Retrieval | | | | |
| Pre | 7; 16th | 9; 37th | 8; 25th | 7; 16th |
| Post | 7; 16th | 10; 50th | 8; 25th | 8; 25th |
| Repetition | | | | |
| Pre | 8; 25th | 9; 37th | 7; 16th | 8; 25th |
| Post | 8; 25th | 8; 25th | 7; 16th | 8; 25th |
| Auditory Comprehension | | | | |
| Pre | 11; 63rd | 11; 63rd | 11; 63rd | 9; 37th |
| Post | 9[c]; 37th | 10; 50th | 9[c]; 37th | 9; 37th |
| Alternative Communication | | | | |
| Pre | 97; 42nd | 105; 63rd | 100; 50th | — |
| Post | 103[c]; 58th | 98[c]; 45th | 101; 53rd | 92; 30th |
| BNT (total out of 60 ; percentage) | | | | |
| Pre | 7; 12% | 32; 53% | 13; 22% | 15; 25% |
| Post | 8; 13.3% | 34; 57% | 22[c]; 37% | 17; 28% |
| CADL (total out of 120; percentile; stanine) | | | | |
| Pre | 68; 35th; 4 | 74; 47th; 5 | 75; 49th; 5 | 62; 25th; 4 |
| Post | 78; 55th; 5 | 77; 54th; 5 | 81; 62th; 6 | 69; 38th; 4 |
| CETI (total out of 160) | | | | |
| Pre | 48 | 46 | 35 | 48 |
| Post | 61 | 53 | 45 | 52 |
| Change Score | 13 [c] | 7 | 10 | 4 |
| RCPM (total out of 36) | | | | |
| Pre | 32 | 34 | 30 | 25 |
| Post | 35 | 33 | 30 | 23 |
| CLQT (standard score; rating) | | | | |
| Composite Severity Rating | | | | |
| Pre | 2.8; Mild | 3.4; Mild | 2.8; Mild | — |
| Post | 2.2; Moderate | 3.4; Mild | 2.6; Mild | — |
| Attention | | | | |
| Pre | 190; WNL | 177; Mild | 182; WNL | — |
| Post | 176[c]; Mild | 188[c]; WNL | 187; WNL | — |
| Memory | | | | |
| Pre | 79; Severe | 142; Mild | 74; Severe | — |
| Post | 79; Severe | 142; Mild | 73; Severe | — |
| Executive Functions | | | | |
| Pre | 24; WNL | 24; WNL | 25; WNL | — |
| Post | 19[c]; Moderate | 29; WNL | 23[c]: Mild | — |
| Visuospatial | | | | |
| Pre | 95; WNL | 88; WNL | 95; WNL | — |
| Post | 84; WNL | 96; WNL | 94; WNL | — |

*Note.* RCPM = Raven's Coloured Progressive Matrices. CLQT = Cognitive Linguistic Quick Test. CETI = Communicative Effectiveness Index. CADL = Communicative Activities of Daily Living. ADP = Aphasia Diagnostic Profiles. BNT = Boston Naming Test. [c]Reached study criteria for clinical significance.

Table 3.9

*Participants' Performance on Outcomes Measures of Discourse Abilities*

| | | Participants | | | |
|---|---|---|---|---|---|
| **Stimuli** | **Measure** | **A.C.** | **B.J.** | **C.G.** | **D.B.** |
| Cookie Theft Picture | Total words | | | | |
| | Pre | 21 | 112 | 15 | 25 |
| | Post | 38 | 76 | 13* | 14 |
| | Total sample time, min., (sec.) | | | | |
| | Pre | 0.75 (45) | 3.4 (202) | 1.1 (67) | 4.3 (255) |
| | Post | 0.93 (56) | 4.9 (293) | 0.9 (55) | 2.8 (170) |
| | Words per minute, (per sec.) | | | | |
| | Pre | 28 (0.47) | 32.9 (0.55) | 13.6 (0.2) | 5.8 (0.10) |
| | Post | 1.3 (0.02) | 15.5 (0.26) | 14.4 (0.2) | 5 (0.08) |
| | Total CIUs | | | | |
| | Pre | 1 | 39 | 8 | 13 |
| | Post | 4 | 51 | 10 | 7 |
| | CIUs per minute | | | | |
| | Pre | 1.3 (0.02) | 11.8 (0.19) | 7.3 (0.1) | 3.02 (0.05) |
| | Post | 40.9 (0.68) | 10.4 (0.17) | 11.1 (0.2) | 2.5 (0.04) |
| | % CIUs | | | | |
| | Pre | 0.05 | 35 | 53 | 52 |
| | Post | 11 | 67[c] | 77[c] | 50 |
| Cinderella Narrative | Total words | | | | |
| | Pre | 87 | 298 | 4 | 72 |
| | Post | 160 | 281 | 5* | 46 |
| | Total sample time, min., (sec.) | | | | |
| | Pre | 2.77 (166) | 7.3 (439) | 0.1 (6) | 4.5 (268) |
| | Post | 3.32 (199) | 8.43 (506) | 0.3 (20) | 3.9 (231) |
| | Words per minute (per sec.) | | | | |
| | Pre | 31.4 (0.52) | 40.8 (0.68) | 40 (0.7) | 16 (0.27) |
| | Post | 48.2 (0.80) | 33.3 (0.56) | 16.7 (0.3) | 11.9 (0.20) |
| | Total CIUs | | | | |
| | Pre | 26 | 61 | 3 | 35 |
| | Post | 44 | 156 | 5 | 23 |
| | CIUs per minute | | | | |
| | Pre | 9.39 (0.16) | 8.4 (0.14) | 40 (0.7) | 7.8 (0.13) |
| | Post | 13.3 (0.22) | 18.5 (0.31) | 30 (0.5) | 5.97 (0.10) |
| | % CIUs | | | | |
| | Pre | 30 | 20 | 75 | 49 |
| | Post | 28 | 56[c] | 100[c] | 50 |

*Note.* CIUs = Correct Information Units. [c]Reached study criteria for clinical significance. *The size of the discourse sample has been shown to influence test-retest stability with smaller sample sizes related to increased variability in performance (Brookshire & Nicholas, 1994).

measured by the ADP). For the participant (B.J.) a decline in alternative communication (on the ADP) was demonstrated instead, which was not a focus of ILAT. No participant demonstrated a clinically significant change on the Raven's.

**5. Quantitative Responses to the Participant Experience Survey**

Responses to the Participant Experience Survey were used to answer research question 4. In general, all participants in the present study reported overall positive experiences with ILAT. All participants 'liked to participate' and noted some positive 'changes in abilities from before treatment.' Additionally, participants noted improvements in other group members and in their own abilities. Quantitative responses for the Participant Experience Survey are provided next.

**5a. Participant A.C.** As illustrated in Table 3.10, A.C. generally provided positive ratings on the participant experience survey (Median=4; IQR =1). Her lowest ratings (i.e., 1-2), indicating the most negative experiences with the ILAT program, suggested that she perceived the training as exhausting and monotonous. Her highest rating (i.e., 5), indicating positive experiences with ILAT, suggested that she 'liked to participate' in ILAT to a high degree. A.C. perceived positive changes compared to before treatment.

**5b. Participant B.J.** As illustrated in Table 3.10, B.J. generally provide positive ratings on the survey questions (i.e., 4 or 5 on all but one question; Median=5; IQR=1). In response to the question on the number of training hours per day (question 10), she gave the lowest rating possible (i.e., 1). She stated, "*9-1pm, training before lunch*," indicating that she preferred a treatment session that started earlier in the morning without a break. In response to the survey question about noticing any changes compared to before ILAT, B.J. rated the change to be 'to a very high degree.'

**5c. Participant C.G.** As illustrated in Table 3.10, C.G. generally provided positive ratings on the Participant Experience Survey (Median=4; IQR = 1). He never responded to a survey question with the lowest rating (i.e., 1). His lowest ratings (i.e., 2) were noting the training to be exhausting and the need of adjustment in the number of training hours. He also gave a more neutral response (i.e., rated as a 3) in relation to the "training as monotonous." He gave the highest ratings (i.e., 5), indicating a positively perceived experience in response to the survey, on the following ILAT areas: the intensity of the training matching needs and daily schedule, the usefulness of the ILAT program, willingness to participate again, and positive changes compared to before treatment.

**5d. Participant D.B.** As illustrated in Table 3.10, D.B. generally provided positive ratings on the participant experience survey (Median=4; IQR = 0). She never responded to a survey question with the lowest rating (i.e., 1). She indicated a negative experience (i.e., rating of 2-3) with the picture material and with the training as being monotonous and exhausting. For her highest ratings (i.e., 5), D.B. reported a positive experience or perception for the number of hours of ILAT per day. She felt the intensity of the training matched her needs and was useful. She provided further responses/examples to explain her survey answers. She added to her rating for survey question 10 regarding the number of training hours per day, indicating that the number of training hours impacted her ability (and her transportation) to attend sessions or to be on-time by stating, "*schedule, son and daughter-in-law and ride…Yeah, but working son and daughter-in-law but yes.*" For the question on changes from before treatment (question 12) she added, "*better, excellent, speaking syllables, fine, now fine.*" D.B. perceived positive changes related to the treatment and she reported positive experiences with ILAT overall. Next, qualitative responses for each participant on the Participant Experience Survey are described.

Table 3.10

*Quantitative Responses to the Participant Experience Survey*

| | Participants | | | |
|---|---|---|---|---|
| | A.C. | B.J. | C.G. | D.B. |
| *1. To which degree did you like to participate?* | 5 | 5 | 4 | 4 |
| *2. To which degree did you like the picture material?* | 4 | 4 | 4 | 3 |
| *3. To which degree were the different categories appropriate for you?* | 3 | 5 | 4 | 4 |
| *4. To which degree did you like the different levels of difficulty?* | 3 | 5 | 4 | 4 |
| *5. To which degree did the level of difficulty match your abilities?* | 3 | 4 | 4 | 4 |
| *6. To which degree did you experience the training as exhausting?* | 1 | 5 | 2 | 3 |
| *7. To which degree did you experience the training as monotonous?* | 2 | 5 | 3 | 2 |
| *8. To which degree did you experience the training as useful?* | 4 | 4 | 5 | 5 |
| *9. To which degree did the intensity of the training match your needs?* | 4 | 5 | 5 | 5 |
| *10. Would you liked to change the number of trainings hours per day?* | 3 | 1 | 2 | 5 |
| *11. To which degree did the intensive language training fit with the rest of your daily program?* | 4 | 4 | 5 | 4 |
| *12. To which degree did you experience any changes compared to before we started with this?* | 4 | 5 | 5 | 4 |
| *13. Is this change on the positive or negative side of the axis?* | 4 | 5 | 5 | 4 |
| *14. To which degree did the program fulfill your expectations?* | 4 | 4 | 4 | 4 |
| *15. Would you participate again?* | 4 | 5 | 5 | 4 |
| Mean (SD) | 3.5 (1.0) | 4.4 (1.1) | 4.1 (1.0) | 3.9 (1.0) |
| Median | 4 | 5 | 4 | 4 |
| Interquartile range (IQR) (upper quartile - lower quartile) | 1 (4-3) | 1(5-4) | 1 (5-4) | 0 (4-4) |

*Note*. Participant Experience Survey from Kirness & Maher (2010) has been converted to a 1-5 likert scale with (- -) = 1, (-) = 2, (0) = 3, (+) = 4, (++) = 5.

In response to research question 3, these results from the quantitative responses from the Participant Experience Survey suggested that participants had positive perceptions towards ILAT in general. Next the qualitative responses from the Participant Experience Survey will be provided.

**6. Qualitative Responses to the Participant Experience Survey**

As mentioned, the Participant Experience Survey was used to address research question 4 of participant perceptions in response to ILAT. Open-ended interview questions from the Participant Experience Survey were included to potentially provide additional or supplemental information and clarification in relation to quantitative responses. Qualitative responses were categorized as: 1) enjoyed group setting; 2) support for clinical researcher; 3) communicative improvements in others and in self; 4) desire for continued services; 5) break not needed during ILAT; and 6) frustration with probe assessments.

**Enjoyed group setting.** Three participants reported that the group format of the therapy was appreciated. When asked if there was anything about ILAT that A.C. liked especially well, she said, "*it was my friends*." B.J. said, "*The class is really good because the communicative. The class is fun…I enjoy the company, the study, the group is great."* D.B. called the group a team, saying, *"Determination me, but team excellent."*

**Support for clinical researcher.** Two participants suggested supportive feelings in regards to the clinical researcher. D.B. said*, "C.G. and, name, B.J., and A.C.* (naming other participants)*, excellent…and you* (clinician), *excellent really."* Another participant, A.C. was a mother, as described previously, and often appeared to be interested in the life and educational goals of the clinical researcher by comments and question made commonly throughout the treatment program. When asked if there was anything else that A.C. would like to comment on at the end of the survey, she said, "*Nope, but uh you* (clinician), *it is truly…Okay* (pause)*…*(she begins to cry)*…Oh my God…Okay, nevermind, anyway, whatever."*

**Communicative improvements in self and in others.** Participants reported to not only notice self improvements, but also to note improvements in other participants. Two participants noted group improvements. B.J. stated, "*we have learned a lot, we have understand the sentence, we understand the project, we understand the, the um the play, the play in the room (moves her hand in a circular motion), it's really impress, working harder, we, the group is really conversing, it's helped."* D.B. suggested perceived improvements and success in other group members by stating*, "Oh nice speaking team, speaking Oh C.G.* (other participant) *speaking excellent, you know, and Gosh, name?...B.J.* (other participant)*, Oh God speaking excellent, and A.C.* (other participant) *too you know, proud."* D.B. appeared to perceive others to improve more than her, because she was "*lazy*," stating, "*team excellent. God C.G.* (other participant)*! And all. Me lazy, but speaking sentences, better*."

Three participants reported self improvements. B.J. reported, "*I learned a lot…I can see a difference, it's good, it's really good."* In response to the general open-ended question about his opinion of the ILAT program, C.G. appeared to suggest that he perceived his speech-language abilities to have improved throughout the course of the program by repeating, "*It's good, better, better, better*." When asked if there were any other areas of training that she would like, D.B. also indicated to notice improvements in her "talking." She stated, *"talking, better and better…me excellent, but now, smart, but talking is hard hard… me lazy, but speaking sentences…better, but talking, but hard, but coming you know… me stroke years and years, and lazy, but coming."*

**Desire for continued services.** All four participants noted that more training would be beneficial. When asked if there were other language areas that A.C. would like to have more training in, she replied, "*everything, you know, everything*." B.J. reported that she would like to have more training in "*communication, sentence, words."*

**Break not needed during ILAT.** When asked if the number of hours should be changed, A.C. appeared to indicate that she felt that the training should start earlier at 8am and end earlier without a break/snack-time, by stating, "*Um no but it was eat and it's gone, this way, uh it's, look* (she wrote the number '8') *and then it's done. I mean for me*." C.G. mentioned that the break time in the middle of the day should be taken out of the program by saying, "*snacks minus 15*."

**Frustration with probe assessments.** A.C. was the only participate to report a negative experience. When she asked if she 'experienced anything in the ILAT program as being negative' she reported to dislike the continuous assessment using the probes. A.C. stated, "*This right here, blah* (pointing to probing score sheet), *I'm sorry, but oh my God, here we go, here we go, for me, frustrating.*"

In summary and in regards to research question 4, the qualitative and quantitative responses on the Participant Experience Survey appear to suggest that participants, in fact, did have positive perceptions towards ILAT. A discussion on findings from the present study in relation to each research question has been provided next.

## Chapter Four: Discussion

The purpose of this study was to examine the effectiveness of Intensive Language Action Therapy (ILAT) in individuals with nonfluent aphasia, using a variety of outcome measures (proximal, primary, and secondary) to determine which might best index individual response to the intervention. The results of this study suggested modest evidence for the effectiveness of ILAT for this subpopulation of individuals with aphasia. Additionally, two main contributions to the literature on ILAT were provided. First, the findings of the present study contributed to ILAT literature by identifying important factors to consider with regard to implementation of the treatment and its components. Second, outcome measures to be considered in order to best investigate and document the effectiveness of ILAT in the future were delineated.

To facilitate discussion of results, Table 4.1 provides a simple summary of whether or not there were meaningful changes on the proximal outcome measures for both trained and untrained items. Also shown are clinically significant changes on primary and secondary standardized outcomes for participants. Recall that based on previous research, it was predicted that the participants would show improvements on proximal, primary, and secondary outcomes. Clearly this was not the case for all participants. Indeed, the most apparent observation from Table 4.1 is that contrary to that which was suggested by initial group studies of ILAT (Meinzer et al., 2005; Pulvermuller et al., 2001), the findings across outcome measures in the present study demonstrated that ILAT may not result in similar outcomes for all individuals with nonfluent aphasia. These findings will be discussed in regard to individual response to each of the research questions proposed.

Table 4.1

*Summary of Changes in Proximal, Primary, and Secondary Outcomes*

| Outcome Measures | A.C. | B.J. | C.G. | D.B. |
|---|---|---|---|---|
| Proximal Outcomes | | | | |
| *Trained items* | N | Yes | P | Yes |
| *Untrained Items* | No | Yes | Yes | No |
| Primary Outcomes of Language Abilities | | | | |
| *Aphasia Severity* | D | No | D | Yes |
| *Auditory Comprehension* | D | No | D | Yes |
| *Alternative Communication Abilities* | Yes | D | No | No |
| *Confrontational Naming* | No | No | Yes | No |
| Primary Outcomes of Social-functional communication | | | | |
| *Communicative Effectiveness and Social Validity* | Yes | No | No | No |
| *Spoken Discourse Production* | No | Yes | Yes | No |
| *Social-functional communication Allowing Multiple Modalities* | Yes | No | No | No |
| Secondary Outcomes of Cognitive-Communication Abilities | | | | |
| *Attention* | D | Yes | No | N/A |
| *Executive Functioning* | D | No | D | N/A |

*Note.* Yes=clinically-significant gain in posttreatment outcome performance. No=no gains found in posttreatment outcome performance. D=A clinically significant decline in posttreatment outcome performance. N/A=Unable to complete assessment. P =Partial change. N =Negligible change.

## Proximal Outcomes

**Trained items.** First, consider the findings for proximal outcomes. It was hypothesized that participants would demonstrate improvements in accuracy of performance for trained and untrained items during daily probes of a social-functional communication task that was directly trained during ILAT. With regard to trained items, the hypothesis was partially supported in that two (B.J., D.B.) out of four participants met a predetermined criterion for demonstrating meaningful change in performance (a change of ≥20%) for both training sets and met the study's criteria for level of performance during training (i.e., 80% accuracy). One participant (C.G.) demonstrated partial positive changes on performance on trained items with a change in score of

≥20% for one training set, although the level of performance did not reach 80% accuracy. Finally the fourth participant, A.C. did not show any changes on performance of trained items.

Only one previous study examined communication performance on trained items during ILAT. Kurland et al. (2012) reported improvements on trained items for both of the participants in their study. Given that one participant in the present study showed no improvements, one partial improvements and only half of those participating (*n* = 2) clinically significant improvements, the present results are in contrast with Kurland et al.

There are two potential reasons for the lack of clear improvements for two of the four participants in the present study. First, the two participants who did not show clearly meaningful changes in performance were able to produce the names of objects but not an adjective to describe the object, while those who showed meaningful changes were able, quite quickly, to move to producing utterances that contained both the object name and an adjective – i.e., the latter two participants were producing verbal requests at the highest level of complexity. As a result of the shaping principle in which the complexity of the task-requirements are matched to individual abilities, participants producing the verbal requests with high levels of complexity had more practice and more repetitions of the entire verbal request during ILAT than did the two participants who were performing at the less complex level. Perhaps, if the two participants that remained at the lower level of complexity were required to say the entire verbal request (with a clinician model) immediately, proximal outcomes for these individuals would have been higher in accuracy for completing the task and more similar to outcomes observed in the two other participants. Taken as a whole, these mixed results may be interpreted to suggest that the shaping of the task requirements may have a significant influence on each participant's performance for proximal outcomes.

The second potential explanation for the mixed findings on proximal outcomes, may relate to the fact that the participant for whom there was not even a partial improvement (A.C.) was unable to complete homework/maintenance activities consistently, secondary to her communication partner's work-schedule and unexpected inability to provide daily assistance. Other aphasia treatments have addressed this potentially confounding variable by providing participants with a verbal model using some form of technology. For example a Talking Photo Album is used along with the Arizona Writing Treatment (Beeson, Rising, Kim, & Rapcsak, 2010) to help increase accuracy during homework/maintenance activities. Proximal outcomes for the participant may have been higher in accuracy with the ability to complete homework/maintenance activities with high accuracy and with consistent assistance from a communication partner.

**Untrained items.** Generalization from trained items to untrained items was found for only one (B.J.) of the two participants who made marked improvements on trained items. Additionally, one participant that demonstrated only partial gains in performance during training (C.G.) demonstrated improvement on untrained items. Generalization from trained to untrained items was not demonstrated by participants in the study by Kurland et al. (2012), but it should be noted their proximal outcome was different than the one used in the present study (i.e., confrontational naming vs. the entire verbal request). In contrast, generalization of trained items to similar untrained items was reported by Faroqi-Shah and Virion (2009), even though the proximal outcome examined again was different (i.e., morphosyntactic skills). Thus the finding of mixed results in the present study, with some participants demonstrating generalization and others not, is consistent with the mixed results previously reported in the literature.

There are numerous potential explanations for the differences in findings of generalization across the present and the studies by Kurland et al. (2012) and Faroqi-Shah and Virion (2009). Factors which may have influenced results include differences in clinician feedback, participant characteristics, and protocol for administering probes. One important difference between studies was the requirements during probing for proximal outcomes. Kurland et al. (2012) measured outcomes of confrontational naming only; whereas an entire verbal request was required in the present study. Generalization may have occurred in the Kurland et al. study if other parts of the tasks required during ILAT (other than the item-name) were assessed in untrained and trained items (e.g., carrier phrase, description, number). Indeed, these other parts of the tasks were required during trainining in the present study and may more accuractely reflect skills learned in ILAT. Although the finding for generalization of items trained during ILAT (proximal outcomes) to untrained items, is promising in regard to the effectiveness of this treatment, many potential confounding variables related to the research design, such as instability in baseline, chatacteristics or balancing of the stimuli sets, and inability to counterbalance the application of the treatment across participants may have contributed to these findings and require further examination. One other ILAT study, however, supported this finding with participants demonstrating generalization of trained skills to similar untrained items (Faroqi-Shah & Virion, 2009).

In sum, although early research (Meinzer et al., 2005; Pulvermuller et al, 2001) with ILAT purported that it was an aphasia treatment that could be used to improve language outcomes and social-functional communication in individuals with any type of chronic aphasia, more recent research have only partially supported those findings (Faroqi-Shah & Virion, 2009; Kurland, 2012; Meinzer et al., 2005). The present study and recent research have suggested that not all of the individuals with aphasia who received ILAT have improved social-functional communication abilities, like those assessed as proximal outcomes in the present study. In the next sections the hypothesis that ILAT will lead to improvements on primary measures of language outcomes and social-functional communication abilities will be explored, respectively.

**Primary ILAT Outcome of Language Abilities**

Table 4.1 highlights the primary language outcomes where at least one participant demonstrated a clinically significant change. In terms of aphasia severity, or the level of overall language impairment, as assessed with the ADP, only one participant (D.B.) showed a clinically significant change. Although Pulvermuller et al. (2005) concluded from the original ILAT study that the intervention led to significant changes on an overall measure of language abilities, they did not report results for individual participants. In other ILAT studies (Faroqi-Shah & Virion, 2009; Kurland et al., 2012;Maher et al., 2006; Meinzer et al., 2005), not all participants showed improvements on overall language abilities. Thus the findings in the present study that only one of the four participants demonstrated a significant improvement on an overall measure of language abilities is not particularly surprising.

In terms of the specific language skills, it can be seen in Table 4.1 that only one participant improved on auditory comprehension (as measured by the ADP) and one on confrontational naming skills (as measured by the BNT). Mixed findings on specific language skills, e.g., confrontational naming subtests, have previously been reported in the literature (Faroqi-Shah & Virion, 2009; Kurland et al., 2012; Maher et al., 2006) with approximately half of the participants demonstrating improvements.

Additionally, in an individual that appeared to make the most improvements during ILAT (B.J.), a posttreatment decline in alternative communication abilities, a subtest on the ADP, was found; whereas a gain was found in the individual (A.C.) who made the least gains. Although unclear and preliminary, the finding may suggest a relationship between the ILAT principle and requirement of focusing on spoken language production, compared to relying on compensation for language impairment with alternative forms of communication, and greater gains in response to ILAT in social-functional communication abilities (Maher et al., 2006; Pulvermuller et al., 2001).

An important observation that has not previously been reported in the literature relates to the two participants who did not demonstrate clear clinical improvements on the proximal outcomes (A.C., C.G). These participants actually demonstrated a clinically significant decline in performance on assessments in language impairment on the primary outcomes.

There are many participant characteristics that may be potential prognostic indicators for positive or negative response to ILAT primary outcomes of language abilities. Aphasia severity has been suggested as a prognostic indicator of outcomes in language abilities. Aphasia severity has been suggested to be more related to outcome than most other factors, such as gender or age, with more increased severity predicting less improvement in language outcomes (Lee et al., 2009). In some of the previous ILAT research (Faroqi-Shah & Virion, 2009; Meinzer et al., 2007), however, individuals with more severe aphasia demonstrated the most gains, particularly in language abilities (i.e., naming and repetitions skills). The present study tends to support this claim. One participant (D.B.) with the most severe aphasia (as determined by the ADP with pre-treatment assessments) demonstrated only small improvements on proximal outcomes, however, she was the only individual to demonstrate a clinically significant improvement in aphasia severity (classifying her as less severe) at post-treatment assessment. The participant classified with the least severe aphasia (B.J.) demonstrated the most improvements in proximal and secondary outcomes, but with no improvements noted in overall language abilities.

Additionally, high pretreatment performance of memory skills (as measured by the CLQT) and confrontational naming skills (as measured by the BNT) may have also been related to improvements in language abilities in response to ILAT. Cognitive-communication abilities, such as nonverbal reasoning, have been related to language outcomes in previous aphasia treatment research (Beeson, Rising, & Volk, 2003; Wambaugh, Cameron, Kalinyak-Fliszar, Nessler, & Wright, 2004). The influence of pre-treatment confrontational naming abilities on response to ILAT may be explained by the requirement of this form of naming within the verbal request task completed during the treatment. Perhaps individuals that have relatively good naming abilities at baseline may be able to focus more, and consequently make more improvements, on the other task-requirements within ILAT.

Taken as a whole, the findings for the primary outcomes in language suggest that contrary to the initial contention of Pulvermuller et al. (2011), ILAT does not necessarily lead to clinically significant improvements in language function for all individuals with aphasia. As suggested previously, perhaps the components of the treatment, including the shaping principle, or participant characteristics are critical to a positive prognosis associated with ILAT. In this study, an attempt was made to provide detailed descriptions of participant characteristics and treatment procedures, which have been limited in description in previous ILAT research (Meinzer et al., 2005; Pulvermuller et al., 2001).

**Primary ILAT Outcome of Social-Functional Communication**

Recall that a benefit of ILAT is that it is an aphasia therapy held in a group setting. The intervention focuses on spoken language abilities and the social-functional communication abilities needed in everyday, life activities. This study used an objective measure of social-functional communication abilities, the CADL which includes role-play situations (e.g., asking for help at a grocery store) that would typically occur in daily life. No previous ILAT study has used this form of outcome measure. Few studies (Faroqi-Shah & Virion, 2009; Kirmess & Lind, 2010; Maher et al., 2006) have examined spoken discourse production, which reflects another critical daily, communicative activity that requires spoken language. Ratings of social-functional communication skills were used by two of the previous ILAT studies (Meinzer et al., 2005; Pulvermuller et al., 2001), which provide a subjective, yet, valuable, perception of an individual's social-functional communication by a person who communicates with the individual regularly. In the present study, social-functional communication was measured by the *Communication Activities of Daily Living* (CADL; Holland, Porter, & Howard,1999), changes in discourse production, and the *Communicative Effective Index* (CETI; Lomas, Pickard, Bester, Elbard, Finlayson, & Zoghaib, 1989). The proximal outcomes measures also provided an assessment of social-functional communication.

**Communication ratings.** Recall that the CETI provides communication ratings by a communication partner that communicates with the participant on a regular basis. The CETI was previously used in a group study by Meinzer et al. (2005) who reported that all 12 of their participants showed significantly higher changes than at baseline. In contrast to the results reported by Meinzer and colleagues, only one participant in the present studies demonstrated clinical significant improvements on post-treatment performance on the CETI. The findings across participants, instead of in relation to individual response, reported by Meinzer et al. (2005) may have masked the findings and contributed to the difference observed across studies. The differences between the findings of the present study and the study by Meinzer and colleagues may also be related to participant characteristics. The one participant who showed a clinically significant change on the CETI did not show improvements on either proximal outcome measures and/or any of the language measures. This participant (A.C.), however, did show improvements on the CADL, a measure of social-functional communication allowing multiple modalities. Overall, the fact that only one participant showed changes on the CETI and that these changes did not appear to relate to changes on proximal outcomes measures and/or language measures, suggests that the CETI may not be the most appropriate measure for indexing ILAT outcomes.

**Spoken discourse production.** Another measure of social-functional communication in this study was an assessment of spoken discourse skills. Spoken discourse production was also examined by Maher et al (2006) and Faroqi-Shah and Virion (2009), with ¼ to ½ of the participants in those studies failing to show any changes in discourse skills, respectively. Maher et al., (2006) described discourse production outcomes by asking clinicians to rate the discourse abilities for improvements; while Faroqi-Shah and Virion (2009) examined discourse abilities for changes in syntax. In the present study, the discourse samples were examined, primarily, in order to calculate a percentage of correct information provided in relation to the discourse stimuli, which provides an efficient assessment of social-functional communication performance with ecological validity (Brookshire & Nicholas, 1994). Thus, although different metrics were used, it is perhaps not surprising that only two of the participants in the present study showed clinically significant changes (B.J., C.G). Of interest is that the participant with the greatest change in CIUs (B.J.) was the only participant who had a medium effect size (4.2) for performance on the proximal outcome measure (Beeson & Robey, 2006). Perhaps more importantly B.J. and C.G. were the only two participants that demonstrated improvements on untrained items in the proximal outcome task. These findings suggest that there may indeed be a relationship between performance during ILAT and functional outcomes, at least as measured by discourse analysis.

It is important to note, however, that discourse skills have been reported to largely vary over repeated sample times in general (Cameron et al., 2010). Recent research has suggested that individual variability on discourse performance is even greater than previously suggested (Brookshire & Nicholas, 1994; Cameron et al., 2010). Perhaps an assessment of discourse abilities could be potentially valuable for describing ILAT outcomes, if the influence of individual variability was better controlled in discourse analysis. In order to control for individual variability when measuring changes in discourse in individuals with aphasia, researchers have recommended establishing stable baselines in discourse performance prior to the application of treatment.

**Multimodal communication.** A unique contribution to the literature from the present study was the use of the CADL. Recall that the CADL was selected because it provides an objective measure of multimodal social-functional communication. Multiple modalities may be used in order to communicate messages on the CADL, which could potentially provide information regarding a change from using compensatory strategies (e.g., using gestures or writing) to using the verbal modality (spoken language production) for social-functional communication. All participants demonstrated an improvement from pre-test to post-test on the CADL, although the change in score exceeded the operationally-defined level of significant change (≥10) for only one participant (A.C.). Interestingly A.C., did not demonstrate improvements in language abilities as measured by standardized aphasia assessment (the ADP), in fact declines were noted. When analyzing responses to CADL items, which were similar to the task within ILAT, such as a verbal request, it was found that A.C. changed her response on two CADL pretreatment responses, from using a verbal-plus-gestural response to using a verbal-only response. Although the change in performance was not significant, there was one other participant (C.G.) who provided an example of changing a verbal-plus-gestural pretreatment response to a verbal-only response at post-treatment. Perhaps these observed changes can be interpreted to suggest that training during ILAT that focused on spoken language production was influencing these post-treatment responses on the CADL. Although the findings are preliminary, the inclusion of assessment tools, such as the CADL, that allow for a demonstration of generalization of trained skills (spoken language production and social-functional communication) to changes in communicative modalities used on a similar untrained outcomes measure.

In sum, three of the four participants showed improvements on at least one social-functional communication outcomes measure. Perhaps the outcome measure from the present study that most clearly relates to skills trained during ILAT was the measure of spoken discourse production. Indeed, the participant, who demonstrated a medium effect size in response to ILAT (proximal outcome), also demonstrated clinically significant improvements in discourse abilities. Another participant who demonstrated the least improvements in proximal outcomes, however, demonstrated clinically significant improvements on the other two outcome measures (CETI and CADL) for social-functional communication. These findings may suggest that the CETI and CADL do not reflect skills trained during ILAT as well as other outcome measures would that focus more specifically on spoken social-functional communication.

## Secondary ILAT Outcomes of Cognitive-Communication Abilities

The present study has also contributed to the literature as it is the first study to systematically include a secondary outcome measure which may change as a function of ILAT, a measure of cognitive-communication abilities. In aphasia treatment research cognitive-communication abilities have been shown to be related to language outcomes (Beeson, Rising, & Volk, 2003; Wambaugh, Cameron, Kalinyak-Fliszar, Nessler, & Wright, 2004). The findings from the present study may be interpreted to support this contention, in that the two participants who showed declines in language abilities (A.C., C.G) of aphasia severity and auditory comprehension also showed declines in sub-skills of cognitive-communication abilities. When comparing these findings to individual response to ILAT using proximal outcomes, proximal outcomes for A.C. and C.G. for trained items during ILAT were shown to be negligible and partial, whereas both B.J. and D.B. were able to reach an a priori study criterion for meaningful change in response to treatment. Perhaps most encouraging, is the finding that one participant who had the largest effect size for proximal outcomes (B.J.), and who also demonstrated significant improvements on the discourse production task, was also the only participant to show a clinically significant benefit on one of the cognitive-communication abilities (i.e., attention). Taken as a whole these data are intriguing and suggest that assessment of cognitive-communication abilities should be considered in future ILAT studies.

## Participants' Perceptions of ILAT

The responses on the Participant Experience Survey indicated that participants' generally perceived positive experiences associated with the ILAT program and were satisfied with the treatment. According to the American Speech-Language-Hearing Association (2004), the assessment of client perceptions of a treatment should be included in clinical practice for communication disorders. Determining client perceptions of aphasia treatments may be critical to the ongoing enrollment of individuals with aphasia in aphasia treatment programs, such as ILAT. Thus the overall positive perceptions of the participants' experience in the present study provided a valuable outcome associated with ILAT.

Although all participants reported overall positive experiences with ILAT in the present study, three negative perceptions must be discussed first. One participant (A.C.) reported the repetitiveness of the probes for the social-functional communication task to be "frustrating." Perhaps future ILAT single-subject research studies should use a multiple probe design that decreases the repetitiveness (Horner & Baer, 1978). Participants reported a desire for continued services in speech-language therapy after completing ILAT. These perceptions could indicate that the length of the ILAT intervention was not perceived as sufficient and/or that ILAT was not perceived as effective enough. The need for continuation of speech-language services, however, appears to be a common theme for individuals participating in group therapies with chronic aphasia and group therapy often provides a cost-effective option for continued services (Marshall, 1999). Finally, negative perceptions were reported in relation to having a break in the middle of ILAT. Three of the four participants seemed to perceive the training as exhausting and monotonous. However, participants negatively perceived the break that was provided in the middle of the therapy day as an interruption. The break was discussed amongst participants during the session preceding the interview, which may have biased the participants' responses to be more aligned with one another. Participants also reported that the intensity of the treatment matched their needs, suggesting that although exhausting and monotonous, ILAT was tolerable for the participants in the present study. Kirmess (2011) previously noted that ILAT participants appeared gratefulness to be a part of an intensive treatment research study and viewed ILAT as a form of work obligation, appearing to appreciate a strict structure to their day. Future studies should further examine participants' perceived tolerance of ILAT.

As mentioned previously, the majority of the responses on the Participant Experience Survey, quantitative and qualitative responses, were positive. The treatment alone may not have been the sole cause for these perceptions. One explanation for these positive responses may be that the same clinician who provided the treatment assessed perceptions of the treatment. In qualitative response, participants appeared to support this clinical-researcher. The findings would be less biased if a clinician other than the one providing the treatment conducted the interview of client perceptions (Berg, 2007). Another explanation for the positive perceptions could have been the use of a coping strategy. Optimism, or an individual's positive outlook about a condition and its potential outcome, has been reported to be a coping strategy for individuals with chronic conditions, such as aphasia (Parr, 1994). Participants in the present study may have used the coping strategy, influencing participants' responses to be more positively loaded.

It may be possible, however, that the positive experiences reported by participants were directly related to characteristics of the therapy program. Previous research has suggested that people with aphasia found certain environmental factors to positively facilitate participation in community (e.g., the small social unit of the group setting). Some of these environmental factors are found within ILAT, such as familiarity (e.g., getting to know the clinical researcher and other participants through the group setting), opportunity for participation (e.g., turn-taking opportunities within the language game), and availability of extra support for communication (e.g., personalized cues and repetition to assist in communicative requirements given by the clinician and other participants) (Howe, Worrall, & Hickson, 2008). Responses on the

Participant Experience Survey appeared to provide valuable insight into the participants' perceptions of ILAT.

**Limitations**

An overall limitation to any intervention study is the large network of potential unidentified or interacting variables. Several factors related to the research design of the present study may have influenced the results and their interpretations for the present study, including the following: (1) order effects (without counterbalancing), (2) instability noted in baseline performance, and (3) generalization of trained to untrained items.

Since four subjects participated as a group in the ILAT program, four replications of the treatment was examined, through a single-subject, multiple baseline design across behaviors. The order of stimulus presentation could not be counterbalanced, because the participants were trained in a group. According to Thompson (2004) single-subject multiple baseline designs across participants would ideally include a replication for each participant with the same order of stimulus presentations (e.g., training sets) and counterbalancing of stimulus presentations across participants. An order effect may have been a confounding variable to participant outcomes in the present study and requires examination in future studies.

The criterion for moving from baseline to treatment phases was determined as a change in probe performance of less than 20% in the three probes preceding treatment. However, participants demonstrated some improvements in performance during baseline, which could have suggested exposure of probe items, and not necessarily the application of the treatment, to be associated with observed improvements. A stricter criterion for administering probes could have better controlled for instability. For example, a minimum of five baseline probes, with the last three probes preceding treatment required to have a level performance or a descending trend (no rise in performance) across experimental sets, has been suggested to establish stability in baseline performance in previous single-subject research (Wambaugh & Mauszycki, 2013).

Additionally, using the multiple baseline design across behaviors to examine the effectiveness of ILAT, it was predicted that minimal generalization (as measured by the response generalization and exposure control sets) would occur to untrained items on the same social-functional communication task. Generalization found in the exposure control sets and response generalization sets can be considered to weaken the internal validity of the single-subject multiple baseline design across behaviors, because the goal of this design is to demonstrate the application of the treatment alone causes systematic changes in performance. However, the demonstration of stable performance on the control task during training of ILAT (without generalization) and demonstrations of the effect of ILAT related to the application of ILAT in four replication (four participants) strengthened the design, because these findings were unlikely to have been a cause of external factors.

Another limitation to the study is the role of the clinician as the interventionist and the data collector and assessor (Berg, 2007). The familiarity between the clinician and participants may have biased the findings, weakening the internal validity of the study. Conducting interjudge reliability assessments for probes and pre-posttreatment outcome measures, however, strengthens the validity of the study. Additionally, methods for establishing group consensus of interview coding and using an interdisciplinary perspective to establish codes for responses on the Participant Experience Survey enhanced credibility of the data analysis (Berg, 2007; Muttiah et al., 2011).

**Future Directions**

Research is needed to further address treatment components within the ILAT sessions and characteristics of participants, such as aphasia severity, baseline cognitive-communication abilities, and performance on proximal outcomes, which may serve as prognostic indicators of a positive or negative response to ILAT. In order to statistically examine the presence or absence of a relationship between specific participant characteristics and participant performance, a larger sample size would be required. As mentioned in a review of the first decade of research on ILAT by Meinzer, Rodriguez, and Gonzalez Rothi (2012), future research should continue to examine characteristics that may serve as prognostic indicators of individuals with aphasia that would benefit from ILAT as well as those who would not be appropriate candidates. Additionally, the information gained from the Participant Experience Survey may better represent general perceptions of ILAT with a larger sample size (Berg, 2007).

Treatment procedures have varied greatly in previous ILAT literature, which perhaps should cause researchers to wonder if they were really examining the same treatment. For example, treatment procedures found in the present study to potentially influence the findings included the following: (1) feedback provided by clinicians to shape the task requirements to the participant's abilities, (2) the number of opportunities each participant had to practice skills trained during ILAT, (3) the influence of accurate completion of homework/maintenance activities.

In previous ILAT literature, researchers used a variety of cues (e.g., phonemic, semantic, sentence completion) with no specification of the means for choosing cue-types and no inclusion of a post-treatment analysis to specify which types of cues were used (Kurland et al., 2012; Maher et al. 2006). In the present study, the chosen cue-types provided to the participants were personalized and semantically loaded (Marshall & Freed, 2006). Future research should define the cues chosen for ILAT studies beforehand or after completion of the study, along with a rationale for the chosen cueing methods.

The number of opportunities or attempts at communicating made by each participant, was not regulated a priori and may have influenced the effectiveness of ILAT in the present study. Out of the four participants in the present study, two participants reached a higher level before the others, using the ILAT procedure of shaping the treatment to participants' level of performance. Therefore, these two participants had more opportunities at completing the entire request. Those participants that were at a higher level, initially, performed higher overall, as would be expected, on probe performance. Recent research has indicated that the number of opportunities to practice (e.g., in naming) is related to outcomes (Fillingham, Sage, & Ralph, 2005). The shaping procedures should be systematically examined for its effect on ILAT outcomes. Additionally, during training in the present study participants had ~15 opportunities or turns in the language game to practice the social-functional communication task of requesting, completing at least four games each day and taking up to 10 minutes to get around the table for each participant to have one turn. Future research should examine the number of communication attempts (or turns in the game) for each group member in relation to outcomes. In addition, to analyzing the number or opportunities to complete the social-functional communication task, an analysis of other communicative acts completed during ILAT sessions (e.g., clarifying, assisting other group members) should also be examined. These other communicative acts most likely effected performance on the social-functional communication task and may be a better measure of direct skills targeted in ILAT.

Participant performance during maintenance (homework) activities may have influenced performance on ILAT. In fact, one participant who demonstrated the least gains during probe sessions on the social-functional communication task reported to have difficulties in completion of maintenance activities. Previous research on ILAT has not demonstrated significant differences between individuals who completed related activities outside of ILAT and those who completed ILAT without homework (Meinzer et al., 2005). These findings, however, were only reported in one study. Further research is needed to determine the influence on ILAT outcomes from homework and/or maintenance activities completed along with the ILAT training program

The feedback provided by the clinician and group members may have influenced the findings. In the present study, the clinical researcher provided positive feedback to reinforce the use of spoken language production, by responding to participants' verbal requests during ILAT, with "good work" or "good try." Then the clinician requested further information or clarification, as described in the clinical manual. However, one group member (B.J), in particular, provided negative feedback to her peers, by saying, "No!," whenever a mistake was made. This participant was reminded of the rules to request clarification instead of noting mistakes. The other groups members appeared annoyed by the feedback and even requested positive feedback from the individual. The participant, however, continued to provide negative feedback, which may have impacted the results. The importance of using positive feedback in ILAT has not yet been systematically examined and perhaps should be in future research.

It still remains unclear which or if any of the neuroscientific principles that form the basis of ILAT treatment components have contributed to ILAT outcomes. As a reminder, the required treatment components for ILAT have included the following: focusing on spoken language production to communicate messages, shaping the requirements to suit the needs and level of performance of each participant, training in an intensive-format, and practicing communication in a behaviorally relevant context of group communication with tasks that require turn-taking and communicative exchanges using the speech act of a verbal request. Previous ILAT research has suggested various levels of focusing or constraint on spoken language production. For example, in some ILAT studies participants were made to keep their hands under their legs if needed to prevent the use of hand-gestures during treatment (Maher et al., 2006). Other researchers have supported the use of hand-gestures during ILAT, as means of self-cueing speech or in addition to verbal communication (Pulvermuller & Berthier, 2008). The influence of the focusing requirements on ILAT outcomes requires further investigation.

As mentioned in previous ILAT research and demonstrated in the present study, adaptations to the ILAT protocol and shaping procedures used within ILAT requires further research (Faroqi-Shah & Virion, 20009). In the present study, the procedures for shaping the task requirements to each clients' abilities (e.g., personalized cues, using words more common in everyday language initially, and increasing the difficulty in spoken language production with improvements in performance) are not necessarily those applied in all previous ILAT studies. The influence of each of these procedures has not yet been systematically examined.

Perhaps more importantly, continued research on the effects of intensity of treatment is required. It remains unclear if the intensity of ILAT used in the present study (25 total hours in 10 consecutive week-days) and in previous ILAT studies (24-30 total hours in 8-10 consecutive weekdays) (Cherney et al., 2008) provides the best ILAT dosage. Few studies have systematically examined the effects of dosage for aphasia treatment, in general (Raymer et al., 2008). Criteria of dosage in aphasia treatments have been largely one of convenience or based on requirements of a third-party payer, not based on evidence. It is still unknown for how long of for how intense a particular aphasia treatment should be implemented. These are some of the most relevant issues in aphasia intervention schemes. Further research of the effects in ILAT, compared to the same treatment in a less intensive application, is warranted. Systematic replication of findings across studies, researchers, participants, and across settings (stimulus generalization) is still required to determine effectiveness of ILAT and its adaptations.

**Conclusion**

Two main contributions of the present study were to describe the effectiveness of ILAT by describing outcome measures that may best index changes associated with ILAT and to provide information on individual response to ILAT in a subpopulation of individuals with nonfluent aphasia. Perhaps, more importantly, the findings of the present study contributed to ILAT literature by providing researchers with important factors to consider in order to effectively and systematically study the effectiveness of ILAT in the future.

The results of the present study suggested that participants classified with nonfluent aphasia respond differently to ILAT and that improvement in language outcomes may not be demonstrated by all individuals with aphasia, as initially suggested (Pulvermuller et al., 2001). Individuals demonstrated not only improvements, but also declines on primary and secondary outcomes associated with ILAT, such as overall language abilities and cognitive-communication abilities. Three of the four participants demonstrated improvements in measures of social-functional communication. Participants demonstrated modest improvements in proximal outcomes, on a social-functional communication task of the verbal request, directly trained during ILAT. This improvement on proximal outcome measures appeared to relate in some manner to performance on primary and secondary outcomes. Individuals with nonfluent aphasia (and communication partners) in the present study appeared to perceive a positive treatment experience and positive changes associated with the ILAT program, indicating a consumer interest for ILAT. Therefore, empirical evidence behind its effectiveness remains necessary. Future ILAT research should more thoroughly address characteristics of the provided treatment and of participants included in ILAT studies, and the influence these components may have on ILAT outcomes.

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## Appendix A: Experimental Stimuli

| Stimuli | Set | Category | Syl | No | Freq | F | AI | AN | VC |
|---|---|---|---|---|---|---|---|---|---|
| fish | 1 | animal | 1 | 3 | 35 | 3.18 | 2.92 | 0.29 | 3.53 |
| leg (knee) | 1 | body part | 1 | 5 | 58 | 4.76 | 3.75 | 0 | 2.76 |
| dog | 1 | four-footed animal/ animal | 1 | 2 | 75 | 4.41 | 3.5 | 0 | 3.18 |
| clothespin | 1 | man-made object | 2 | 3 | 0 | 3.82 | 4.83 | 0 | 2.18 |
| envelope | 1 | man-made object | 3 | 3 | 21 | 4.29 | 4.83 | 0.98 | 1.29 |
| traffic light(s) (stop light) | 1 | man-made object | 3 | 5 | | 4.47 | 4.17 | 0 | 3.06 |
| rolling pin | 1 | man-made object/ kitchen utensil | 3 | 2 | | 2.41 | 4.83 | 0 | 2.12 |
| helicopter | 1 | man-made object/ type of vehicle | 4 | 4 | 1 | 2.53 | 3.33 | 1.21 | 4.65 |
| chain | 1 | man-made object/ weapon | 1 | 2 | 50 | 2.29 | 4 | 0.29 | 2.13 |
| pumpkin | 1 | vegetable | 2 | 4 | 2 | 2.53 | 4 | 0.32 | 2.53 |
| eagle | 2 | animal | 2 | 2 | 5 | 1.82 | 3.67 | 0.5 | 4.29 |
| peacock | 2 | animal | 2 | 2 | 2 | 2.24 | 4.75 | 0 | 4.47 |
| eye | 2 | body part | 1 | 5 | 122 | 4.82 | 2.83 | 0 | 3.41 |
| sandwich | 2 | man-made object | 2 | 3 | 10 | 4.47 | 3.33 | 0 | 2.65 |
| wheel | 2 | man-made object | 1 | 5 | 56 | 2.41 | 3.08 | 0.32 | 2.18 |
| pot | 2 | man-made object/ kitchen utensil | 1 | 4 | 28 | 4.71 | 2.5 | 1 | 1.76 |
| saltshaker | 2 | man-made object/ kitchen utensil | 3 | 5 | 0 | 4.47 | 4.33 | 0 | 2.35 |
| accordion | 2 | man-made object/ musical instrument | 4 | 4 | 1 | 2.06 | 3.33 | 0 | 4.06 |
| French horn | 2 | man-made object/ musical instrument | 2 | 3 | | 1.88 | 3.92 | 0 | 4.18 |
| doorknob | 2 | man-made object/ part of a building | 2 | 2 | 3 | 4.29 | 3 | 0 | 2.29 |
| horse | E | animal | 1 | 2 | 117 | 3.47 | 4.5 | 0.5 | 3.65 |
| penguin | E | animal | 2 | 5 | 0 | 1.82 | 3.75 | 0 | 3.88 |
| watering can | E | man-made object | 4 | 3 | | 3.06 | 4 | 0 | 2.65 |
| glove(s) | E | man-made object/ article of clothing | 1 | 4 | 9 | 3.59 | 3.17 | 0.32 | 2.41 |
| hat | E | man-made object/ article of clothing | 1 | 4 | 56 | 3.65 | 3.42 | 1.48 | 1.65 |
| tie | E | man-made object/ article of clothing | 1 | 2 | 23 | 3.71 | 3.75 | 0 | 1.94 |
| violin | E | man-made object/ instrument | 3 | 4 | 11 | 2.65 | 4.75 | 0.29 | 3.59 |
| nut | E | man-made object/ tool | 1 | 3 | 15 | 2.59 | 4 | 0 | 1.88 |
| football | E | man-made object/ toy | 2 | 2 | 36 | 1.76 | 4.67 | 0.5 | 1.94 |
| pepper | E | vegetable | 2 | 5 | 13 | 3.35 | 3.83 | 0.99 | 2.29 |
| goat | G | animal | 1 | 4 | 6 | 2.47 | 4 | 0 | 4 |
| ostrich | G | animal | 2 | 2 | 0 | 1.71 | 3.08 | 0.61 | 3.88 |
| key | G | man-made object | 1 | 5 | 88 | 4.88 | 3.33 | 0 | 2.06 |
| spinning wheel | G | man-made object | 3 | 2 | | 1.59 | 2.33 | 0 | 3.82 |
| thimble | G | man-made object | 2 | 3 | 1 | 2.71 | 4.92 | 0 | 2.12 |
| sock(s) | G | man-made object/ article of clothing | 1 | 3 | 4 | 4.76 | 3 | 0.59 | 1.81 |
| watch | G | man-made object/ article of clothing | 1 | 2 | 81 | 4.76 | 3.42 | 1.29 | 2.65 |
| chisel | G | man-made object/tool | 2 | 5 | 4 | 2.06 | 2.25 | 0 | 2.56 |
| pliers | G | man-made object/tool | 2 | 2 | 1 | 2.24 | 2.42 | 0 | 2.24 |
| asparagus | G | vegetable | 4 | 5 | 1 | 2.82 | 4.17 | 0 | 2.41 |

Note. Set = treatment set; E = exposure control set was used during each probe assessment but not used during treatment, G = response generalization set was presented only during baseline and post-treatment testing sessions; category = category given by Snodgrass et al. (1980) and/or Rossion and Pourtois (2004). syl = number of syllables; no = the number of pictures on the stimulus picture card; freq = the frequency count given by Francis and Kucera (1982). The CELEX database (natural log frequency from the CELEX database; R. H. Baayen, R. Piepenbrock, & Gulikers, 1995) was also used after the sets were formed in order to make decisions on which four cards from each set should be introduced first as those of "high" frequency in everyday language; Familiarity (F), agreement of image (AI), agreement of name (AN), and visual complexity (VC) ratings were obtained from norms from Rossion and Pourtois (2004).

# Appendix B: Clinician's Manual

***Clinician's Manual***
Examining the Effectiveness of Intensive Language Action Therapy in
Individuals with Nonfluent Aphasia

| **Criteria** | **Date Met:** |
|---|---|
| Single-left hemisphere stroke | |
| Pre-morbid speakers of English | |
| Hearing and vision corrected WFL | |
| Nonfluent speech (as measured by ADP) | |
| *apraxia of speech, ABA-2 (subtest 2A), and clinical markers* | |
| No current aphasia treatment | |

Hearing Screenings: Performance on pure tone air conduction thresholds at 40 dB at 500, 1000, 2000 Hz bilaterally

| **40dB** | **500Hz** | **1kHz** | **2kHz** |
|---|---|---|---|
| Right ear | | | |
| Left ear | | | |

| ***Assessments*** | ***Pre-test Date*** | ***Post-test Date*** |
|---|---|---|
| Confrontational Naming with Rossion & Pourtois (2004) Pictures: | | N/A |
| *Pyramids and Palm Trees Test:* | | N/A |
| Semantic Processing, Spoken Word-Picture Matching (PALPA 47): | | N/A |
| Written Word-Picture Matching (PALPA 48): | | N/A |
| Word Semantic Association (PALPA 51): | | N/A |
| Rhyming PALPA Rhyme Judgment Requiring Picture Selection (PALPA 14) | | N/A |
| Word Rhyme Judgment (PALPA 15): | | N/A |
| *Boston Naming Test (BNT):* | | |
| *Communication Abilities in Daily Living (CADL2):* | | |
| *Communicative Effectiveness Index (CETI)*: | | |
| Cinderella story re-telling: | | |
| *Cognitive-Linguistic Quick Test (CLQT):* | | |
| *Raven's Coloured Progressive Matrices:* | | |
| *Geriatric Depression Scale (GDS):* | | |
| *Aphasia Diagnostic Profiles* (ADP): | | |
| Participant Experience Survey/Interview | N/A | |
| Non-Word Oral Reading (PALPA8) (control task) | | |
| Non-Word Oral Reading (PALPA 8) (control task) | | |
| Non-Word Oral Reading (PALPA 8) (control task) | | |
| Social- Functional Communication Task (all sets of stimuli) | tested continuously | |

*Clinicians (especially new clinicians) should first practice giving each test at least twice to someone without aphasia using the video/audio recorder to workout troubleshooting with test administration and equipment. [Other psycholinguistic assessments may have better explained underlying deficits. Additionally, other tests on quality of life and social-functional communication abilities, suggested in the discussion section of the paper, should be added to better understand ILAT outcomes.]

(Page 1 of 6)

Probe Administration Form

*(probes are administered for 10-15 minutes with each participant before the treatment program begins for the day)*

ID: _________ Phase: __________________________

Date: ________

Experimenter: __________

Instructions (modified from Kirmess, 2011): *"I will show you a picture. Can you produce a question about the picture? Your question should include an addressing (my name), a question phrase, the object (in other words what the picture shows), and a property of the object.*
*For example, "Rachel, do you have two black pens?" Now you try.*

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Picture Card/Concept | | | | | | | | | | |
| Carrier Phrase | | | | | | | | | | |
| Number | | | | | | | | | | |
| Description/ Property | | | | | | | | | | |
| Object Name | | | | | | | | | | |
| **Total Points** | | | | | | | | | | |

(2=correct, 1=mostly correct, 0=incorrect)

Points converted to percentage: __/100 %

*Scoring instructions:*

• If participants self-correct or change a response, score the correction/changed response
• With the carrier phrase, one point if given if the participant provides the name of the opponent and one point is given for the question phrase (for a total of two points possible)
• With the number requirement, if the number provided on the picture card does not match the number given by the participant, a zero is scored. If the correct number is given with 2-3 phonemic errors, one point is scored. If the number is given with one phonemic error or no phonemic errors, two points are scored.
• The description/property given must be present in the picture card to receive credit. A description/property given for an item may be scored as one point it does not represent/describe the main properties within the picture, but does describe some property within the picture card/item.
•The object name may be in the singular or plural form to receive full credit (two points), and differences will not count as a phonemic error.
• The object name may contain one phonemic error to receive full credit (two points). If two or three phonemic errors occur, but the word is recognizable as the target word, the participant receives one point.

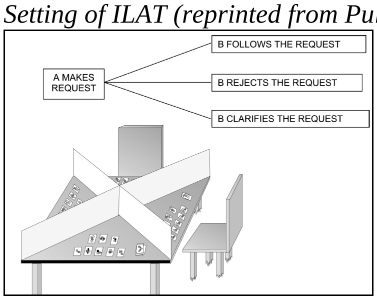
## Treatment Manual

(For assessment of treatment integrity: *Place a '√' or 'X' in the box if procedures are followed /not followed—use the experimenters daily notes section to make notes regarding errors in following the protocol)(convert to %)*

**ILAT Game Overview and Setting.**
The principle activity within ILAT involves a language game where the "action structure of this language game is that of a typical request communication" (Pulvermüller & Berthier, 2008, p. 577). Participants play a language game in which participants have four to five picture cards and ask each other for cards in order to make pairs (similar to 'go fish'). If another participant has the card they respond by giving it to the person who requested.

- Four participants will be seated facing each other at a table, separated visually by a barrier (see Figure 1).
- The clinician will be seated on a rolling stool so that she may move around the table easily to assist group communicative acts
- The clinician uses a Group Score Sheet (a modified baseline score sheet) to monitor performance of each participant and the number of turns taken by each participant on the functional communication task

Figure 1
*Setting of ILAT (reprinted from Pulvermuller et al., 2008)*




- Participants are dealt (up to 12) picture cards and on each turn ask each other for cards in order to make pairs (similar to 'go fish'). [Five cards per experimental set may have worked best for a single-subject multiple baseline designs across behaviors.]
- If another participant has the card they respond by giving it to the person who requested it, and if not, the person who requested it must draw a card from the deck.
- Once the request and response have been provided, the turn is over.
- The turns move around the table clockwise.
- The game will continue until each match within the deck of cards (i.e., training set) is found.
- Then the game will start over with the training set re-shuffled.

**Introducing ILAT.**
On the first day of treatment, the clinician will describe the main objectives of ILAT and the levels of complexity for the treatment (see Figure 2) using a Powerpoint presentation and a video example.
*For the next two boxes, only supply X or √ on assessment of treatment integrity for the first treatment session.*

- Using a powerpoint presentation, including pictorial and key word assistance, the clinician will describe the verbal requirements of each level within the game
- Next, the clinician provides a short video example of the treatment procedures being conducted with a research assistant and the clinician, using picture card-sets that will not be used during any part of the training.

**Shaping of the stimuli/verbal requirements.**

- The clinician takes out picture cards of higher frequency in everyday language (e.g., dog, cup, and couch, saving items such as camel, vase, and hutch for later) (~half of the set being trained). These picture cards from the first treatment set are laid out on the table.
- The examiner asks the participants, *"What are the names for each of these pictures?"* and immediately encourages the participants to talk amongst each other to figure out what to call each of the pictures.
- Once each participant is able to produce items initially introduced at Level 1 (see Figure 2), usually within the first session/hour, the remaining items/items of lower frequency in everyday language are introduced in the same way.

(Page 3 of 6)

Figure 2

*Levels of complexity (Modified protocol from Maher et al., 2006)*

Participants are required to use only spoken language production to complete communicative acts during the language game across four levels of difficulty. After a participant has successfully produced the functional communication task at least twice at one of the levels described below, the participant moves on to the next level.

Materials: Pairs of matching picture cards (e.g., Rossion and Pourtois (2004) provide a good option with a standardized set of 260 pictures, with norms for name agreement, image agreement, familiarity, and visual complexity); each pictured item must be portrayed by a descriptor noun: e.g., a pair of red books and a pair of gray books or a pair of four red books and a pair of picture cards of one red book, but these descriptors are only required later in the treatment once participants are successful in levels 1 and 2.

Level 1: Shaping rule constraints: Object
Request: Speaker communicates: "book?"
Response: Opponent communicates: "yes, book" or "no, book"

Level 2: Shaping rule constraints: Carrier phrase + object
Request: Speaker communicates: "Sue, Do you have a book?"
Response: Opponent communicates: "Yes, I have a book." Or "No, I do not have a book."

Level 3: Shaping rule constraint: Carrier phrase + number+ object
Request: Speaker communicates: "Sue, Do you have two books?"
Response: Opponent communicates: "No, I do not have two books."

Level 4: Shaping rule constraints: Carrier phrase + number + description + object
Request: Speaker communicates: "Sue, Do you have two red books?"
Response: Opponent communicates: "Yes, I do have two red books."

**Shaping of stimuli/picture cards.**

- The gray-scale pictures may be used initially (Levels 1-3) and those identical pictures in color are introduced as the participants move through the levels of the treatment to allow for comparisons within the stimuli for descriptions of the pictures (Level 4).

**Cueing/feedback.**

Participants are not allowed to use other modes of communication, such as gestures or writing to communicate. However, participants are allowed to use a gesture behind their visual barrier as a self-cue without allowing the other participants to see the gesture or without using the gesture as the only mode of communication, the gesture will be permitted—The goal is to focus communication on verbal production not to stop self-cues, such as gestures or hand movements, which may be naturally associated and combined with spoken language production.

***A participant uses gestures to communicate along with spoken language production (√) or gestures to communicate without spoken language production and without clinician requesting spoken language production (X). Observed (out of up to 10 opportunities total-all participants):***

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|

- Group members will be informed that they should not solely rely on the clinician to play the game in order to allow a more natural flow to the conversation. They will be encouraged to help each other by asking for clarification or more information. If the participant is unable to think of an opponent's name, the clinician will encourage participants to ask each other their names.
- The group members will be told that each group member should first attempt to request a card on their own initially. Each participant should be given 10-15 seconds to request independently. The relatively short timeframe to respond is meant to allow a conversational-like flow among group members. The clinician will instruct group members that "*if a group member, after their initial attempt (in the 10-15 second time frame), does not provide all of the information needed for the request other group members should ask for the information or for a clarification.*" For example, if a group member was at level 3 and asked another group member, "Do you have the anchor?" the respondent would be encouraged to reply, "which anchor do you need?" so that all of the necessary information is provided in the response.
- In general, the clinician will provide positive reinforcement or feedback, while being honest to participants about their performance. For example, if a participant only provides a partial request the clinician would say, "Great job at providing your opponent, Mr. X, with the object that you are looking for, the anchor…Now we need some more information to complete your turn." This can also cue another group member to ask for clarification.

(Page 4 of 6)

***Personalized Cues***: If a participant still cannot come up with the name of the object on the picture card, the clinician/participant will develop 'Personalized Cues' for the patient for the requested object (word-level) initially. First, the clinician will name the picture on the card. Next, the clinician will tell the patient to create a cue by saying, "think of something special to help you to remember this object." Next, the clinician will elaborate, shape, or modify the cue for content (to be associative/semantic) and length (to maintain the time constraints of the language game) and record each personalized cue for each participant. Finally, the clinician highlights the relationship between the cue and the word. An example of the procedure by Marshall and Freed (2006, p.105) is provided below.

***Clinician:*** ***Presents item and gives name (e.g., ''This is bathrobe'').*** **/** Participant: No response required.

***Clinician:*** ***Instructs client to create a cue. For example: ''Think of something special to help you remember bathrobe.''*** **/** Participant: Responds. For example: ''Um, red, old, old, love it.''

***Clinician:*** ***Elaborates, shapes, modifies cue for content and length. For example, ''OK, it's old; it's red; you're really fond of it. Old, red, favorite; will that work?''*** **/** Participant: Verifies.

***Clinician:*** ***Highlights relationship between cue and word. For example: ''OK, the word is bathrobe. The way you remember it is old, red, favorite.''*** **/** Participant: Confirms, ''yes'' or ''no.''

***A participant still cannot come up with the name of the object on the picture card, a personalized cue is developed or a developed cue is used (√)*** **or a personalized cue is not developed cue or a developed cue is not used when warranted *(X). Observed (out of up to 10 opportunities total-all participants):***

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|

- Required repetition: Once the picture name is determined the participant will be required to say the word and then say the entire request. If the participant has only minimal disfluencies while saying the request, the participant will be asked to repeat the request up to two times after the clinician provides a model of the request.

***Observed (out of 10 opportunities total-all participants):***

Participant 1:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|

Participant 2:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|

Participant 3:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|

Participant 4:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|

- Training on the first set will continue until at least two participants have reached the training criterion of 80% acc. If one or two participants have met criterion, treatment on the set will be continued for up to three days before moving on to the next treatment set.

**Homework.**

- Once participants moved to treatment set 2, participants are given the picture cards/training sets in which they had already reached criterion (set 1) for maintenance.
- The training items are printed on homework sheets (8-½" x 11" standard copy paper) for a communication partners to use with the individual with aphasia while practicing the treatment at home.
- Homework instructions are discussed with the communication partners during the baseline testing phase of the study and again when the first treatment set was mastered. If the participant is unable to make a request, the communication partner models the request and has the participant repeat the model.
- The communication partner and participant demonstrate understanding of the homework instructions in front of the clinician by demonstrating a few requests by the participant/modeling by the communication partner before taking the homework sheets home.
- Homework is collected at the beginning of each treatment day. The communication partner and participant are asked their opinion on their performance to monitor enactment of treatment, to try to monitor exposure to the treatment outside of the therapy session, and to determine if further training with the communication partner may be required. [Perhaps a more efficient alternative to the procedure would have been the use of a Talking Photo Album with minimum communication partner support needed (only to keep track of practice time).]

(Page 5 of 6)

***Experimenter Daily Notes***

Pre-testing/Baseline testing:

Day 1:

Day 2:

Day 3:

Day 4:

Day 5:

Day 6:

Day 7:

Day 8:

Day 9:

Day 10:

Post-testing/Generalization:

(Page 6 of 6)

## Appendix C: Daily Group Score Sheet

Scoring: The clinician first records the identification number or initials chosen for each group member. A turn refers to an attempt by the group member to request a picture card from a chosen respondent. In each of the empty boxes below each turn, the clinician records three pieces of information: the ID of the respondent of the request, the picture card item name, and a check mark or a X (correct vs. incorrect) to score **only** the initial attempt made by the group member during the turn.

| Game # for the day: ______ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Group member | Turn 1 | Turn 2 | Turn 3 | Turn 4 | Turn 5 | Turn 6 | Turn 7 | Turn 8 | Turn 9 | Turn 10 |
| ID:<br>______<br><br>Level:_ | | | | | | | | | | |
| ID:<br>______<br><br>Level:_ | | | | | | | | | | |
| ID:<br>______<br><br>Level:_ | | | | | | | | | | |
| ID:<br>______<br><br>Level:_ | | | | | | | | | | |

| Game # for the day: ______ | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Group member | Turn 1 | Turn 2 | Turn 3 | Turn 4 | Turn 5 | Turn 6 | Turn 7 | Turn 8 | Turn 9 | Turn 10 |
| ID:<br>______<br><br>Level:_ | | | | | | | | | | |
| ID:<br>______<br><br>Level:_ | | | | | | | | | | |
| ID:<br>______<br><br>Level:_ | | | | | | | | | | |
| ID:<br>______<br><br>Level:_ | | | | | | | | | | |

**Appendix D: Participant Experience Survey**

| Interview Questions | P1 | P2 | P3 | P4 | Sum | Mean |
|---|---|---|---|---|---|---|
| *1. To which degree did you like to participate?* | ++ | ++ | + | + | 19 | 4.75 |
| *2. To which degree did you like the picture material?* | + | + | + | 0 | 15 | 3.75 |
| *3. To which degree were the different categories appropriate for you?* | 0 | ++ | + | + | 16 | 4 |
| *4. To which degree did you like the different levels of difficulty?* | 0 | ++ | + | + | 16 | 4 |
| *5. To which degree did the level of difficulty match your abilities?* | 0 | + | + | + | 15 | 3.75 |
| *6. To which degree did you experience the training as exhausting?* | ++ | – – | + | 0 | 13 | 3.25 |
| *7. To which degree did you experience the training as monotonous?* | + | – – | 0 | + | 9 | 2.25 |
| *8. To which degree did you experience the training as useful?* | + | + | ++ | ++ | 18 | 4.5 |
| *9. To which degree did the intensity of the training match your needs?* | + | ++ | ++ | ++ | 19 | 4.75 |
| *10. Would you liked to change the number of trainings hours per day?* | 0 | ++ | + | – – | 13 | 3.25 |
| *11. To which degree did the intensive language training fit with the rest of your daily program?* | + | + | ++ | + | 17 | 4.25 |
| *12. To which degree did you experience any changes compared to before we started with this?* | + | ++ | ++ | + | 18 | 4.5 |
| *13. Is this change on the positive or negative side of the axis?* | + | ++ | ++ | + | 18 | 4.5 |
| *14. To which degree did the program fulfill your expectations?* | + | + | + | + | 16 | 4 |
| *15. Would you participate again?* | + | ++ | ++ | + | 18 | 4.5 |

Note. Participant responses to the Participant Experience Survey (Kirmess & Maher, 2010) are provided. The sum and means across participants are provided with (- -) = 1, (-) = 2, (0) = 3, (+) = 4, (++) = 5.

## Appendix E: Raw Data for Probe Sessions (Accuracy Percentages)

| Participant | **Sessions** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Set 1 | *A*1 | *A*1 | *A*1 | *A*1 | *B* | *B* | *B* | *B* | *B* | *A*2 | *A*2 | *A*2 | *A*2 | *A*2 | *A*2 | *A*2 |
| | Set 2 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *B* | *B* | *B* | *B* | *A*2 | *A*2 | *A*2 |
| | ES | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*2 | *A*2 | *A*2 |
| | GS | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*2 | *A*2 | *A*2 |
| | Control | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*1 | *A*2 | *A*2 | *A*2 |
| A.C. | Set 1 | 38 | 43 | 38 | 55 | 53 | 50 | 43 | 60 | 70 | 70 | 70 | 70 | 65 | 63 | 75 | 73 |
| | Set 2 | 43 | 40 | 43 | 60 | 43 | 45 | 50 | 58 | 60 | 75 | 70 | 75 | 68 | 80 | 65 | 53 |
| | ES | 35 | 48 | 38 | 53 | 43 | 43 | 43 | 55 | 55 | 70 | 60 | 65 | 50 | 68 | 65 | 58 |
| | GS | 38 | 48 | 38 | 50 | — | — | — | — | — | — | — | — | — | 63 | 68 | 38 |
| | Control | 43 | 40 | 40 | — | 47 | 43 | 43 | 43 | 40 | 43 | 53 | 40 | 50 | 50 | 53 | — |
| B.J. | Set 1 | 50 | 63 | 65 | 60 | 80 | 90 | 78 | 95 | 93 | 100 | 80 | 95 | 95 | 98 | 100 | 100 |
| | Set 2 | 45 | 53 | 63 | 60 | 53 | 73 | 78 | 80 | 75 | 83 | 100 | 100 | 100 | 100 | 100 | 100 |
| | ES | 40 | 53 | 68 | 65 | 65 | 70 | 78 | 80 | 80 | 90 | 80 | 88 | 88 | 83 | 88 | 80 |
| | GS | 48 | 58 | 48 | 55 | — | — | — | — | — | — | — | — | — | 75 | 80 | 90 |
| | Control | 59 | 47 | 37 | — | 43 | 47 | 47 | 33 | 37 | 40 | 43 | 40 | 37 | 43 | 40 | 43 |
| C.G. | Set 1 | 8 | 30 | 33 | 48 | 43 | 48 | 48 | 30 | 75 | 75 | 70 | 70 | 78 | 80 | 85 | 83 |
| | Set 2 | 18 | 35 | 53 | 55 | 43 | 43 | 48 | 43 | 60 | 78 | 65 | 80 | 73 | 83 | 85 | 75 |
| | ES | 28 | 30 | 43 | 53 | 43 | 50 | 43 | 43 | 58 | 65 | 63 | 65 | 75 | 65 | 65 | 63 |
| | GS | 0 | 35 | 48 | 38 | — | — | — | — | — | — | — | — | — | 65 | 68 | 90 |
| | Control | 20 | 33 | 37 | — | 23 | 20 | 23 | 30 | 33 | 37 | 33 | 30 | 37 | 30 | 37 | 33 |
| D.B. | Set 1 | 35 | 63 | 53 | 58 | 85 | 78 | 90 | 85 | 95 | 100 | — | 95 | 95 | 88 | 90 | 95 |
| | Set 2 | 33 | 55 | 65 | 48 | 60 | 65 | 70 | 73 | 80 | 85 | — | 90 | 80 | 83 | 83 | 90 |
| | ES | 30 | 58 | 53 | 63 | 65 | 85 | 75 | 80 | 80 | 85 | — | 75 | 83 | 85 | 83 | 88 |
| | GS | 20 | 58 | 65 | 48 | — | — | — | — | — | — | — | — | — | 55 | 65 | 80 |
| | Control | 23 | 37 | 30 | — | 27 | 27 | 27 | 33 | 23 | 33 | — | 27 | 30 | 47 | 43 | 37 |

*Note. A*1 = pre-treatment phase. *A*2 = maintenance phase. *B* = treatment phase. ES = exposure control set was during each probe assessment but not used during treatment. GS = response generalization set was presented only during baseline and post-treatment testing session. Control = control task of nonword repetition.

## Appendix F: IRB Approvals

USF
UNIVERSITY OF
SOUTH FLORIDA

DIVISION OF RESEARCH INTEGRITY AND COMPLIANCE
Institutional Review Boards, FWA No. 00001669
12901 Bruce B. Downs Blvd., MDC035 • Tampa, FL 33612-4799
(813) 974-5638 • FAX (813) 974-5618

November 7, 2011

Rachel Goff
Communication Sciences and Disorders
4202 E. Fowler Ave., PCD 1017

RE: **Expedited Approval** for Initial Review
IRB#: Pro00005683
Title: Investigating Intensive Language Action Therapy

Dear Rachel Goff:

On 11/6/2011 the Institutional Review Board (IRB) reviewed and **APPROVED** the above referenced protocol**.** Please note that your approval for this study will expire on 11-6-12.

Approved Items:
Protocol
Document(s):

| | | |
|---|---|---|
| InvestigatingILAT_IRB_Revised.doc | 10/26/2011 2:46 PM | 0.01 |

**Consent/Assent Documents**:

| Name | Modified | Version |
|---|---|---|
| 5683 consent.doc.pdf | 11/7/2011 1:06 PM | 0.01 |
| pictographic_consent.doc.pdf | 11/7/2011 1:06 PM | 0.01 |

Please access the stamped consent forms under the Attachment Tab.

It was the determination of the IRB that your study qualified for expedited review which includes activities that (1) present no more than minimal risk to human subjects, and (2) involve only procedures listed in one or more of the categories outlined below. The IRB may review research through the expedited review procedure authorized by 45CFR46.110 and 21 CFR 56.110. The research proposed in this study is categorized under the following expedited review category:

(4) Collection of data through noninvasive procedures (not involving general anesthesia or sedation) routinely employed in clinical practice, excluding procedures involving x-rays or microwaves. Where medical devices are employed, they must be cleared/approved for marketing.

(6) Collection of data from voice, video, digital, or image recordings made for research

purposes. (7) Research on individual or group characteristics or behavior (including, but not

limited to,
research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Please note, the informed consent/assent documents are valid during the period indicated by the official, IRB-Approval stamp located on the form. Valid consent must be documented on a copy of the most recently IRB-approved consent form.

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval by an amendment.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

John Schinka, PhD, Chairperson
USF Institutional Review Board
Cc: Various Menzel, CCRP
USF IRB Professional
Staff

USF
UNIVERSITY OF SOUTH FLORIDA

DIVISION OF RESEARCH INTEGRITY AND COMPLIANC
Institutional Review Boards, FWA No. 0000166
12901 Bruce B. Downs Blvd., MDC035 • Tampa, FL 33612-479
(813) 974-5638 • FAX (813) 974-561

July 10, 2012

Rachel Goff
Communication Sciences and Disorders
4202 E. Fowler Ave., PCD 1017
Tampa, FL 33620

RE: **Approved** Amendment Request
IRB#:
MS1_Pro00005683
Title: Investigating Intensive Language Action Therapy

(version_2_7/9/12) Dear Ms. Goff:

On 7/9/2012 the Institutional Review Board (IRB) reviewed and approved your Amendment by expedited review procedures.

The submitted request has been approved **from date:** 7/9/2012 **to date:** 11/6/2012 for the following:

Protocol Document(s):
Investigating ILAT
Protocol(0.03)

Consent Document(s):
version2_consentform_7_8_12.pdf(0.01)
version2_pictographicconsentform_7_8_12.pdf(0.1)

Three changes are requested, including a (1) change of adviser and staff, (2) an addition of a site for research, and (3) addition of assessments.
(1) The current adviser, Dr. Arbel, is leaving the university due to a family move from Tampa. Therefore, Dr. Jacqueline Hinckley, an Emeritus Professor here at USF, who is already a member of the current project's research staff will serve as the adviser. The graduate research assistant, Lauren, has now graduated and will not be assisting in the project.
(2) The founder of a non-profit program in Cary, North Carolina for people with aphasia has agreed to become an additional site for research (letter of support provided). The same recruitment procedures that have been approved within the current project would apply. However, the participants would be recruited from the Triangle area of North Carolina, as well as from Tampa. And the research would be conducted at the Triangle Aphasia Project,

Unlimited in Cary, NC as well. The non-profit program does not have a affiliated institution and would therefore agree to follow the policies of the USF IRB if approved.
(3) In order to better describe the characteristics and potential outcomes in the participants new assessments are being added. These assessments will only add minimally to the overall testing time.

- Communication Activities of Daily Living (CADL-2)
- Psychological Assessments of Language Processes in Aphasia (PALPA)
- Apraxia Battery for Adults
- The Boston Naming Test (BNT)
- The Geriatric Depression Scale
- The Pyramid and Palm Trees Test

4. Consent forms revised to reflect changes
5. Protocol revised to reflect changes.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

John Schinka, PhD, Chairperson
USF Institutional Review Board

UNIVERSITY OF SOUTH FLORIDA

DIVISION OF RESEARCH INTEGRITY AND COMPLIANC
Institutional Review Boards, FWA No. 0000166
12901 Bruce B. Downs Blvd., MDC035 • Tampa, FL 33612-479
(813) 974-5638 • FAX (813) 974-561

October 22, 2012

Rachel Goff
Communication Sciences and Disorders
4202 E. Fowler Ave., PCD 1017
Tampa, FL 33620

RE: **Approved** Amendment Request
IRB#:
MS2_Pro00005683
Title: Investigating Intensive Language Action Therapy (version_2_7/9/12)

Dear Ms. Goff:

On 10/19/2012 the Institutional Review Board (IRB) reviewed and approved your Amendment by expedited review procedures.

The submitted request has been approved **from date:** 10/19/2012 **to date:** 11/6/2013 for the

following: Protocol Document(s):
Investigating ILAT Protocol(0.04)

Consent Document(s):
Caregiver Consent Form.pdf(0.01)

1. Change in study staff: Addition of Theresa Chisolm as key personnel
2. Change in population: Addition of caregivers
3. Change in number of participants: Total number of participants increased from 20 to 24
4. Change in consent forms: New Caregiver consent form, v1 dated 10/16/12
5. Revised protocol, v3 dated 10/16/12.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

John A. Schinka, Ph.D.

John Schinka, PhD, Chairperson
USF Institutional Review Board