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USING CORE VERBS TO ANALYZE DISCOURSE OF PARTICIPANTS IN A MODIFIED INTENSIVE COMPREHENSIVE APHASIA PROGRAM

by

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To the Graduate Faculty:

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USING CORE VERBS TO ANALYZE DISCOURSE OF PARTICIPANTS IN A MODIFIED INTENSIVE COMPREHENSIVE APHASIA PROGRAM

Thesis Abstract--Idaho State University (2021)

This research study applied a quantitative method of narrative discourse analysis (core verb performance) to discourse samples from eight people with aphasia (PWA) who attended the Meridian Intensive Aphasia Program (MIAP), a modified intensive comprehensive aphasia program (M-ICAP). The purpose of this study is to combine a highly efficient, clinician-friendly analysis measure with a modification of an efficacious service delivery method. Discourse samples were collected from MIAP participants at pre-treatment, post-treatment and follow-up assessments. PWA's discourse samples from a range of elicitation tasks were transcribed and analyzed for both core verb performance and number of different verbs produced. Descriptive analysis was completed to discern whether PWA's use of core verbs and/or production of different verbs changed after their participation at MIAP. One participant of eight demonstrated a consistent increase in verb measures across a range of discourse task types from pre-treatment to follow-up, and the group as a whole showed an increase in both verb measures for one task type, *Cat Rescue*. The remainder of the data per individual, per task, and as a group was highly variable. Study limitations and future directions are indicated.

Key words*:* Aphasia; Core Lexicon; Modified Intensive Comprehensive Aphasia Program; ICAP; Narrative Discourse Analysis

Chapter I

Introduction

About Aphasia

Aphasia is an acquired neurogenic language disorder which affects production and reception of language across modalities (Hallowell, 2017). Aphasia represents a loss of previously intact language ability (it is *acquired*), resulting from injury, infarct or insult to the brain (it is *neurogenic*). As a *language disorder*, aphasia presents as an impaired ability to formulate outgoing or process incoming linguistic messages across all language modalities, both expressive (producing speech, writing) and receptive (understanding spoken language, reading). Aphasia is specific in its effect on language; that is, other cognitive capacities in the majority of people with aphasia (PWA) remain undamaged (Watila & Balarabe, 2015). Although aphasia is now more common than Parkinson's disease, cerebral palsy and muscular dystrophy, most people have never heard of it (National Aphasia Association [NAA], 2010). It is therefore important to describe not only what aphasia is, but what it is not. Aphasia is a loss of language abilities. Aphasia is not a sensory, motor or speech disorder (though disordered speech may occur concomitantly), and it is not an intellectual or psychiatric disorder (McNeil & Pratt, 2001).

Aphasia is most commonly caused by stroke. Stroke is the fifth leading cause of death in the U.S. and has become the leading cause of long-term disability (Yang et al., 2017). The reported percentage of aphasia among post-stroke patients varies within the published research, but it is estimated that roughly one-third of stroke survivors will acquire aphasia (Ellis et al., 2018). According to a 2010 report by the NAA, there are at least 2 million people living with aphasia (PWA) in the U.S.

Aphasia severity varies widely, influenced by factors such as stroke etiology and severity, lesion size and location, and aphasia subtype (Watila & Balarabe, 2015). People with non-fluent aphasia subtypes (Broca's, anomic, transcortical motor and global aphasias) often present with word retrieval difficulties, agrammatic speech and reduced coherence. Non-fluent aphasias involve damage to the anterior regions of the brain, impacting the production of language more than the understanding of it. Compared to non-brain-damaged (NBD) speakers, people with non-fluent aphasia tend to speak slower, in shorter, clipped utterances, producing fewer words and conveying less content per unit of time. In fluent aphasia subtypes (Wernicke's, conduction, transcortical sensory aphasias), language flows relatively freely, but tends to not carry much substantive meaning or relevance to the topic. Fluent aphasias typically involve damage to the posterior regions of the brain, impacting understanding of language more than production of it. Paraphasias are words or non-words (neologisms) substituted for target words, and are a hallmark of both fluent and non-fluent aphasia subtypes (Hallowell, 2017).

Some spontaneous recovery of impaired language occurs naturally after a stroke, thanks to neuroplasticity, or the brain's ability to change and adapt to internal or external influences (Thompson, 2000; Raymer et al., 2008). According to some estimates, improvements occurring within 90 days post-stroke represent 70% of PWA's maximum potential recovery (Lazar et al., 2010). Many research studies have shown, however, that PWA can improve their communication skills well beyond the immediate post-stroke recovery period via a range of therapy approaches (e.g. Cotelli et al., 2011; Kendall et al., 2015; Links et al., 2010; Mayer & Murray, 2002; Meinzer et al., 2005; Naeser et al., 2005; Raglio et al., 2016; Webster & Whitworth, 2012) and treatment models (e.g. Aftonomos et al., 1997; Barthel et al., 2008; Breitenstein et al., 2017; Campana et al., 2015; Elman & Bernstein-Ellis, 1999; Hoover et al., 2017) that capitalize on

neuroplasticity (Marcotte et al., 2012; Meinzer et al., 2004; Meinzer & Breitsenstein, 2008; Menke et al., 2009; Pulvermüller et al., 2005). One such treatment model, the Intensive Comprehensive Aphasia Program (ICAP; Rose et al., 2013), is growing in use to treat PWA in the chronic phase of recovery (1 year or more post-stroke), and will be examined specifically in this paper.

Literature Review

Treating People with Aphasia

Assessment and treatment of PWA falls primarily within the scope of practice of speech-language pathologists (SLPs) (American Speech-Language Hearing Association [ASHA], 2016). The World Health Organization's International Classification of Functioning, Disability, and Health (WHO-ICF) provides the professional framework within which SLPs define their approach to clients with aphasia. Classification by the WHO-ICF of aphasia takes into account not only the associated cognitive and linguistic deficits but the effect of aphasia on a PWA's engagement and participation in preferred activities and their overall quality of life. As aphasia impairs PWA's ability to communicate, this has implications for their sense of identity, their mental state, their relationships, and their ability to involve other people in their world (Armstrong & Ulatowska, 2007).

Depression and post-stroke anxiety are among the adverse psychosocial effects that PWA experience (Shehata et al., 2015), and with these negative mental states are associated reduced motivation, self-efficacy and self-esteem, which can reduce PWA's positive interactions with caregivers, family, friends and clinicians. Within the WHO-ICF framework, the overarching aim of treatment for PWA is to improve their quality of life by addressing and targeting these psychosocial aspects of aphasia as well as their communicative functioning. Just as it has been

shown that caregivers of PWA also experience reduced health and well-being, effective (and holistic) aphasia therapy may promote positive outcomes for caregivers as well as for PWA (Draper et al., 2007).

Assessment of Aphasia

Standardized assessments are extensively used with PWA, most commonly the *Western Aphasia Battery - Revised* (*WAB-R*; Kertesz, 2007) and the *Boston Diagnostic Aphasia Examination - Third Edition* (*BDAE-3*; Goodglass, Kaplan & Barresi, 2001), which includes the *Boston Naming Test* (*BNT*). The *BDAE-3*, administered most frequently in the U.S., features subtests that measure PWA's auditory comprehension, oral expression, repetition, naming, reading, writing, descriptive speech, conversational responses and narrative discourse (Hallowell, 2017; Richard et al., 2000). Best practice indicates that SLPs should also employ informal, non-standardized measures to assess PWA, particularly in the area of discourse. Measuring discourse gives a more relevant, somewhat less contrived picture of PWA's language skills in an everyday context, and "may be a better predictor of functional communication abilities and treatment outcomes than standard assessment measures" (Dalton & Richardson, 2015, p. S293).

Discourse in Aphasia

The word *discourse* may bring to mind intellectual or political debates among tweed-clad academics, but the reality of discourse is much more ordinary and less cerebral. Discourse is defined structurally as *a unit of language above the sentence* and functionally as *the interactive use of language* (Armstrong, 2000, p. 877). As humans are a social species, discourse is as integral to our existence as language, and the fundamental motivations behind discourse include cooperation, survival and societal engagement (Burton & Dimbleby, 2002). However, discourse

is more than just conversational; discourse is used to provide information, describe and explain (expository discourse), to instruct (procedural discourse), and to tell and retell stories (narrative discourse) (Hallowell, 2017). Each discourse genre involves different demands on a speaker's cognitive and linguistic abilities, which are impacted to various degrees in PWA according to the severity and subtype of their acquired language disorder. For the purposes of this paper, focus will be on expository (single or sequential picture description), procedural (familiar task description), and narrative (telling familiar or unfamiliar stories from pictures or video stimuli) genres of discourse typically included in formal and informal aphasia assessments.

An early study by Brookshire and Nicholas (1994) established recommendations for structured discourse elicitation tasks that produced discourse samples representative of a PWA's communicative abilities. These tasks, widely used in research and co-opted for clinical use by SLPs, include both auditory (spoken instruction/question) and visual (picture) stimuli. Elicitation and production of each discourse type (expository, procedural, narrative) taxes different aspects of the language system and thereby correlates with distinct linguistic and cognitive skills (Stark, 2019). Results from Stark's 2019 comparison of discourse elicitation tasks showed that for 90 PWA, narrative discourse elicited the densest language (in terms of propositional density: number of verbs, adverbs, adjectives, prepositions and conjunctions divided by total number of words) but the smallest percentage of nouns, and procedural discourse elicited less complex syntax and the fewest verbs per utterance of all task types. Expositional discourse elicited the most diverse language (number of different words divided by total number of words) according to Stark's (2019) study, and Olness et al. (2002) found that single pictures (i.e. *Cat Rescue*) elicited more descriptive than narrative statements compared to picture sequences (i.e. *Broken Window, Refused Umbrella*). Because PWA's skill sets vary so widely (e.g. visual processing,

short- and long-term memory, executive functioning), multiple discourse types should be utilized to provide a comprehensive evaluation of language.

Transcription and Analysis in Research and Practice: A Gap

Once discourse samples have been collected via audio and/or video recording, they must be transcribed. This typically involves a clinician listening back and typing out the speaker's words as spoken. Depending on the transcription analysis software being used, markers (symbols, parentheses, letter codes, etc.) are often added to words to denote morphological (e.g. past tense *-ed*, possessive *'s*) or semantic features (e.g. fillers, repetitions, paraphasias). Computerized Language Analysis (CLAN, MacWhinney, 2000) is the software most commonly used in research with PWA according to a 2016 review by Bryant and colleagues. Transcription in CLAN must be done in the CHAT (Codes for Human Analysis of Transcripts) format, illustrated in Figure 1 below, a snippet of a CLAN-coded transcript from MacWhinney et al. (2011). Speaker lines, labeled INV for investigator and PAR for participant, contain some CHAT symbols for repetition (/), revision (//), fillers or sound fragments (&), and gestures or extralinguistic events (&=). The corresponding %mor lines contain labels for parts of speech (e.g. aux for auxiliary verb, pro for pronoun, v for verb), and suffixes (e.g. -PROG for progressive *-ing,* -PAST for regular past tense *-ed*) attached to each of the speaker's words.

Figure 1. *Transcript of PWA coded for CLAN analysis.*

∗INV: can you tell me what you remember about it ?
%mor: aux|can pro|you v|tell pro|me pro:wh|what pro|you v|remember prep|about pro|it ?
∗PAR: I remember falling off the chair and [/] and &w &w &wonder &won wondering what happened to me.
%mor: pro|I v|remember n:gerund|fall-GERUND prep|off det|the n|chair conj:coo|and
n:gerund|wonder-GERUND pro:wh|what v|happen-PAST prep|to pro|me.

∗PAR: and I couldn’t get up &=laughs.
%mor: conj:coo|and pro|I aux|could~neg|not v|get adv:loc|up.
∗PAR: and I [//] it was morning.
%mor: conj:coo|and pro|it v:cop|be&PAST&13S n|morning.
∗PAR: and &uh &um it wasn’t until the afternoon that I called Alice.
%mor: conj:coo|and pro|it v:cop|be&PAST&13S~neg|not prep|until det|the n|afternoon rel|that pro|I v|call-PAST n:prop|Alice.
∗PAR: but I couldn’t say anything.
%mor: conj: coo|but pro|I aux|could~neg|not v|say pro:indef|anything.

(p. 1292; MacWhinney et al., 2011)

An international survey of 123 SLPs by Bryant et al. (2017) revealed that clinicians acknowledge the value of detailed transcriptions, but that they much more often use qualitative (transcription-less) analysis than detailed transcriptions for purposes of determining aphasia diagnosis and severity, and for goal setting and outcome measurement in their practice with PWA. A look at the excerpt above helps illustrate the training required to learn CHAT transcription. One researcher in a 2007 study by Armstrong et al. suggested that one minute of speech from some speakers could take close to an hour to transcribe, and another reported that it takes about 10 minutes to do an accurate phonetic transcription of a 1-minute speech sample, even with the use of transcription analysis software like CLAN. Though detailed transcriptions are the rule in the realm of research, they seem to be the exception in clinical practice. This is tedious time some clinicians hesitate to spend, and research has long recognized the clinical trend toward skipping transcription in favor of qualitative real-time analysis (Armstrong, 2007; Bryant et al., 2017; Dalton et al., 2019; de Riesthal and Diehl, 2018; McNeil et al., 2001; Olness et al. 2012).

There are myriad ways to analyze discourse samples, once transcribed. Research studies abound to describe and compare this wide variance (e.g. Lexical diversity: Fergadiotis et al.,

2013, Cohesion and coherence: Olness & Ulatowska, 2011, Thematic informativeness: Andreetta et al., 2012; McNeil et al., 2001; Nicholas & Brookshire, 1993; Ulatowska et al., 2003, Main event measurement: Capilouto et al., 2006). As language itself can be categorized according to microstructure (the anatomy of language: word classes, syntax, semantics) or macrostructure (the physiology of language: coherence, cohesiveness, main idea, gist), so too can analysis of discourse focus on specific microstructural or macrostructural features, or on elements of both (Armstrong, 2000).

Transcription analysis software, like CLAN, can perform whatever analysis a clinician or researcher desires, with the proper command sequence and coding. Grande et al. (2008) concluded that computer analysis of specific discourse measurements was not just efficient, but more sensitive to pre- and post-treatment changes in PWA's discourse skills than more commonly used standardized rating scales, making it a practicable tool for use in clinical settings. Even so, 61% of clinicians surveyed by Bryant et al. (2017) used analysis of discourse samples as part of their aphasia assessments at least some of the time, but only 37% said they use discourse analysis "usually" or "always." The time-intensive nature of discourse elicitation, recording, transcription, analysis and interpretation was cited as the primary reason for this gap between research and practice (Bryant et al., 2017).

It is often the case that discourse analysis yields information about a PWA's communicative strengths and weaknesses that other assessments fail to capture (Edwards, 1998). Many of the language skills scored in an assessment battery are task-specific and don't quite translate to PWA's ability to communicate in a functional way within the context of their preferred activities of daily living (ADLs). The day-to-day reliance on discourse is the justification for addressing a PWA's discourse performance in both assessment and treatment.

Although naturally occurring spontaneous conversation may be the most common functional communication context, conversational content and format varies too widely within and across individuals to be consistently analyzed and compared (Doyle et al., 1995). Reliability and replicability demand that researchers and clinicians alike rely on structured discourse tasks that evoke samples that can be compared within (pre- and post-treatment) and across (PWA compared to other PWA or to controls) individuals. It is preferable, due to the variability of skills in PWA, to present multiple discourse task types to develop a comprehensive profile on which to build goals and treatment. To target functional communication, it is important that clinicians utilize elicitation tasks that parallel relevant communication contexts as closely as possible.

Despite the vast body of research involving discourse analysis of PWA, there is wide divergence in the published literature of procedures, outcome measures, analysis and findings (Stark et al., 2021). This lack of consistency not only impacts the research, but also complicates the efforts of clinicians to make evidence-based decisions in their practice with PWA. It is little wonder that clinicians reported skirting detailed discourse analysis in Bryant et al.'s (2017) survey. Researchers have recently developed a lexicon-based analysis that does not require an arduous transcription process (Dalton & Richardson 2015; Dillow 2013; Fromm et al. 2013; Kim et al., 2019; Kim & Wright, 2020; MacWhinney et al., 2010). This study was designed to replicate, aggregate and expand on the existing research by combining a reliable, efficient measure of discourse analysis and an effective, efficient model of service delivery (Stark et al., 2021).

Verbs as a Reliable Discourse Measure

Word-finding deficits and lack of coherence/continuity in communication tend to be hallmarks in aphasia, and those deficits are not limited to word class. Verbs contain semantic and

syntactic information which is important for sentence production, often dictating the argument structure (verb + noun phrase). In a sentence produced without a verb, there is an agent with no action, lots of things and nothing happening. Additionally, some verbs map to multiple arguments, so the jumping-off point for other lexical items is missing without retrieval of the verb that maps to them (Webster & Whitworth, 2012). Owing largely to their greater complexity across many linguistic dimensions - phonology, morphology, syntax and semantics - most verbs are typically acquired later in childhood than nouns (Brown, 1973), and are potentially more vulnerable to impairment, as reflected in children with language disorders and people with aphasia (Black & Chiat, 2003).

As verbs are more morphologically complex, some neuroimaging studies have shown increased cortical activation in the left inferior frontal gyrus (LIFG) invoked by verbs than nouns (Tyler et al., 2004). Furthermore, fMRI scans from four PWA in Thompson et al.'s 2013 study showed that intervention targeting complex verb argument structure and thematic role mapping resulted in increased post-treatment activation of cortical regions implicated in verb processing in healthy controls. This might have implications for PWA's neural regeneration post-injury.

Verbs have been shown to be important in differentiating aphasia subtypes and severity: As overall aphasia severity increases, fewer verbs are produced (Dillow, 2013; Mayer & Murray, 2003). In people with agrammatic aphasia in particular (i.e. Broca's), impaired verb retrieval interrupts the semantics of their communicative output, resulting in reliance on single phrases and limited sentence structure that characterizes their disjointed language production (Berndt et al., 1997). Also, agrammatic, nonfluent (Broca's) aphasia is associated with worse verb than noun production in naming tasks (Links et al., 2010). These results reveal that clinical and

treatment decisions regarding word retrieval abilities of PWA should *not* be based on noun production alone.

Many researchers have used verbs as a parameter for measuring aphasia improvement after treatment and as a focus of treatment itself. A study of seven PWA by Conroy et al. (2009) compared participants' ability to name treated verbs using single-word or complete sentence cueing. Data showed that both cueing levels were found to be effective in improving verb naming accuracy immediately post-treatment, and that gains generalized across contexts in a 5-week follow-up assessment: from naming a static photo to naming from dynamic video representations of the same actions. Several studies by Edmonds and colleagues have demonstrated the efficacy of verb network strengthening treatment (VNeST), including one in 2014, which showed that VNeST facilitated improvements in 11 PWA in naming trained and untrained verbs, as well as significant improvements in untrained sentence production in a 3-month maintenance probe (e.g. Edmonds et al., 2009; Edmonds & Babb, 2011; Furnas & Edmonds, 2014). A 2010 study by Links et al. of 11 people with Broca's aphasia showed that a verb production training program called ACTION (Bastiaanse et al., 2004) yielded improvements in untrained verbs, which generalized to spontaneous speech and were maintained 3 months post-therapy. The authors also documented improvements in "communication in daily life" (p. 1304), quantified in terms of increases in mean length of utterance (MLU) and verb diversity. These results are a sample of many that suggest that targeting verbs in therapy yields both specific and lasting treatment effects in PWA.

A 2003 study of 14 PWA by Mayer and Murray compared different measures (% substantive verbs, % word retrieval, % correction of errors) of lexical retrieval in connected speech with respect to word class (noun or verb) and aphasia severity (mild or moderate) across

confrontation naming, expository (sequential picture description) and conversational discourse contexts. Authors found participants with mild aphasia produced significantly more substantive ("heavy" or more complex, vs. "light" verbs: i.e. *disappear* vs. *go*) verbs in the expository than the conversational context, but that the opposite was true for moderate participants. Data also showed that measures of substantive verb production correlated strongly with standardized verb naming measures and percent verb retrieval for the composite condition, and that PWA across the board were significantly more likely to self-correct word finding errors in discourse contexts than the confrontation naming context (Mayer & Murray, 2003). A 2010 study by Peach and Reuter showed that discourse-based semantic feature analysis (SFA) was successful in reducing verb retrieval failures, increasing verbal productivity, and improving informativeness (measured in CIUs: Nicholas and Brookshire's (1993) correct information units) in participants with anomic aphasia. Results from these studies support using discourse-level tasks in aphasia assessment and treatment, as well as individualization of treatment according to aphasia profile.

Core Lexicon (and, specifically, Core Verbs)

Lexicon — that is, words or vocabulary — is the building block of discourse (Kintz et al. 2016), and a shared lexicon is a critical aspect of communication. Core lexicon is a method of quantifying discourse that utilizes a compilation of the most frequently used content words in a number of speakers' elicited narratives. The highest-frequency words in common among the narratives are assembled into core lexicon lists, considered to be pivotal lexical items required to produce a semantically meaningful and coherent narrative (MacWhinney et al. 2010). Stimuli used for core lexicon analysis in aphasia have included the well-known story of *Cinderella* (MacWhinney et al. 2010; Dillow, 2013), a familiar narrative retell task, and the widely-familiar procedural description of how to make a peanut butter and jelly sandwich (Fromm et al., 2013)

as well as the commonly-used picture sequence, *Broken Window* (Dalton & Richardson, 2015), an expository task. "We would intuitively expect that if there are shared events or concepts for a community narrative, then that narrative might also share a common vocabulary" explain Dalton and Richardson (2015, p. S925). Core lexicon production reflects the typicality of PWA's language, or their ability to access that common vocabulary and produce those shared events or concepts, a means of quantifying their discourse performance (Andreetta et al., 2012).

Ecological validity of assessment measures and treatment approaches is important to establish to ensure that they predict and translate to clients' communication abilities in everyday contexts. Core lexicon has been shown to be a discourse measure that is sensitive to capturing PWA's comprehensive language ability compared with healthy controls (Kim & Wright, 2020). Dalton and Richardson (2015) analyzed 238 sequential picture description (*Broken Window*) transcripts from PWA using a 24-item core lexicon list, and found a significant positive correlation between core lexicon performance and main concept (MC) scores (MC is a macrolinguistic measure of accuracy and completeness of essential concepts in a narrative), linking core lexicon measures with PWA's ability to construct the content of a story.

In a 2019 study by Kim et al., discourse samples of PWA were measured using age-specific core lexicon lists for different types of words: nouns, verbs, adverbs & adjectives. Two wordless picture books were used as stimuli: *Good Dog Carl* (Day, 1985) and *Picnic* (McCully, 1984). Core lexicon lists were developed using discourse samples from NBD controls (n=470) who were presented with the same wordless picture books and instructions as PWA. Participants were not asked to describe the pictures, but to build the story from the pictures. The authors separated NBD samples into 7 groups (n=67, on average) by age (20s, 30s, 40s, 50s, 60s, 70s and 80s) and developed lists of the most commonly used words in each word class for each age

group. PWA's discourse samples were measured against the appropriate core lexicon lists for their age group.

According to Kim et al., the normative data revealed that "while comparatively high agreement across age groups was observed for adjectives and verbs, adverb and noun use had considerable variability across the age cohorts" (2019, p. 69). Their analysis of PWA's discourse samples showed that core verbs for both narrative tasks significantly correlated with overall aphasia severity as measured by the WAB-R AQ. No significant correlations were found between core noun production (nor adjective or adverb production) and overall language severity obtained from the WAB-R AQ. This finding was surprising considering the widespread use of assessment and intervention tasks focused on naming noun objects. Results from Kim et al.'s 2019 study demonstrated the ecological validity of core lexicon by connecting it with a standardized measure frequently and consistently used in clinical practice (Stark et al., 2021).

Reliability of core lexicon was affirmed by Kim and Wright (2020) in research that expanded on Kim et al.'s 2019 study by examining the correlation between core lexicon performance in PWA with multiple microlinguistic and macrolinguistic narrative analysis measures. In this reiteration, Kim and Wright (2020) applied the same core lexicon lists they had developed in 2019. The methods for developing the lists had been established in earlier research by MacWhinney et al. (2010) in analysis of PWA's familiar narrative retell of *Cinderella*. Kim and Wright (2020) and Kim et al. (2019) used core lexicon lists separated by word class (nouns, verbs, adverbs, adjectives and "function" words like conjunctions and prepositions) to analyze PWA's narrative retell of unfamiliar stories *Good Dog Carl* and *Picnic*. They found that PWA's core lexicon performance for verbs, measured in terms of percent agreement between verbs used by PWA and verbs on the list, was significantly correlated with micro- and macrolinguistic

measures like syntactic complexity (r=.616), coherence (r=.584), thematic units (r=.532) and lexical diversity (LD, r=.630).

Clinicians are aware of the importance of discourse analysis in aphasia, but the wide range of metrics one could employ to analyze PWA's language, plus the multitude of stimuli available to elicit those samples complicates the clinician's decision-making process, likely contributing to the barrier between research and clinical practice (Bryant et al., 2017; Stark et al., 2021). Research supports the use of core lexicon lists in clinical analysis of aphasic discourse, and several studies have shown that verb production, in particular, correlates with relevant measures of aphasia severity. Additionally, utilizing a core lexicon has potential time-saving advantages because results are easily quantifiable without transcription: clinicians can check for presence or absence of lexical items according to a predetermined checklist while listening to language samples in real time (Kim & Wright, 2020). This process is highly replicable and requires no specialized training, which may increase its appeal for clinicians, who might enlist the help of assistants or interns to listen and check PWA's language samples against pre-made lists. In 2019, Dalton et al. presented a compendium of core lexicon lists developed to date, including *Cinderella*, *Good Dog Carl*, *Picnic* and more and in 2020, Kim and Wright published a tutorial on the development, use and application of core lexicon measures. These contributions can be considered efforts to support the use of core lexicon in both research and clinical applications.

The purpose of this study is to investigate whether discourse analysis streamlined to focus on verb production can effectively and accurately represent PWA's level of functioning and change over time. Because the language samples analyzed in this study were collected from PWA who participated in a modified Intensive Comprehensive Aphasia Program (M-ICAP),

change over time will be established by participant's performance in pre-treatment, post-treatment and a follow-up probe.

ICAP as an Effective Service Delivery Model

Just as clinicians (and PWA) stand to benefit from more streamlined and efficient evidence-based practice guidelines for discourse analysis, PWA (and their caregivers and families) stand to benefit from streamlined and efficient service delivery. PWA are often advanced in years, and important life experiences are happening around them all the time, not slowing or stopping to wait for their recovery or participation. The ICAP is a condensed and intensive service delivery model which has been associated in research with significant improvements in measures of language and life participation for participants with chronic aphasia (Babbitt et al., 2015; Hoover et al., 2017). Research has also demonstrated that ICAPs can facilitate experience-dependent neuroplasticity and functional neural reorganization (Baliki et al., 2018). Designed to capitalize on neuroplasticity associated with rehabilitation intensity, ICAPs aim to maximize communication potential and increase life participation for PWA by integrating individualized intensive communication therapy with group treatment and caregiver support (Rose et al., 2013; Kleim & Jones, 2008).

There is some variance among ICAPs, but Rose et al. (2013) defined features common to all of them: 1) a high intensity of treatment (a minimum of 3 hours per day for at least 2 weeks); 2) utilization of a wide range of approaches to target individualized goals ranging from language impairments to participation in communication; 3) intervention in both individual and group sessions; 4) multiple PWA attend the program as a cohort for a circumscribed period of time. Sessions including technology, counseling, and caregiver/patient education are also defining features of ICAPs. Families can be involved in observation of their loved one's treatment

sessions, participation in group sessions, and education and training sessions and meetings (Rose et al., 2013).

Before 2013, the intensive model was an uncommon service delivery choice, but every year new programs are established including those with modifications to the definition (Rose et al., 2021). Modified ICAPs (M-ICAPs) are typically altered from the original ICAP model in one central feature, such as treatment duration (1 week rather than 2) or inclusion of technology or caregiver training. Despite variance among ICAPs and M-ICAPs, Rose et al. found these commonalities in their 2013 international survey: 1) Most ICAPs are hosted by universities and are funded by client self-pay; 2) ICAPs capitalize on principles of neuroplasticity via intensive therapy dose repeated on a condensed schedule, with highly individualized treatment and evidence-based practices embedded.

As mentioned previously, data on neuroplasticity shows gains can be made in PWA long after the brain insult. In Babbitt et al.'s 2015 study of 74 PWA who attended an ICAP, "many participants considered to have chronic aphasia continued to make significant progress past the time period in which medical professionals report that plateaus occur" (p. S861). Pre- to post-treatment measures showed significant improvement in PWA's naming skills, overall language severity, communication participation and communication confidence (Babbitt et al., 2015). Hoover and colleagues' 2017 study of ICAP group treatment showed significant changes in language impairment, functional communication and quality of life (QoL) measures for 27 participants with chronic aphasia.

Studies by Rodriguez et al. (2013; $n = 11$) and Dignam (2015; $n = 34$) demonstrated group-level maintenance of treatment effects after participation in an ICAP model called Aphasia Language Impairment and Functional Therapy (Aphasia LIFT). Treatment effects included

significant improvement in at least one outcome measure in each domain targeted: language impairment, functional communication and communication-related QoL. A group of 73 PWA demonstrated positive change in aphasia severity, discourse, and communication functioning (client- and family-reported) immediately and again one month after four weeks of a residentially-based ICAP called PIRATE (Winans-Mitrik, et al., 2014).

A study of two ICAPs by Persad et al. (2013) suggested that PWA of any age, whether in the acute or the chronic stage of aphasia, can make gains in functional communication and language skills when provided intensive treatment. Positive changes in psychosocial well-being, including decreased depression and increased QoL were reported in a 2020 study of 37 ICAP participants by Griffin-Musick et al. For people with chronic aphasia and their caregivers, the prospect of improvement in these functional and psychosocial outcome measures is likely what constitutes the appeal of the ICAP.

Despite the growth in the number of ICAPs internationally (Rose et al., 2021), and mounting evidence to support the efficacy of the ICAP model, there are some drawbacks. Clinic-based and hospital-based ICAPs can be prohibitively expensive, for the hosting institution and for participants. The cost for hosts averages about $15,000 to $20,000 per participant, depending on the number of participants (Boyer et al., 2020). Some university-based ICAPs have enlisted SLP graduate students to provide treatment and mitigate costs, while at the same time providing valuable training to students. Out-of-pocket costs can be an impediment for many PWA as well, depending on their insurance and financial circumstances, and it's likely that the nearest ICAP is a considerable distance, so travel expenses and logistics may be a significant barrier.

Treatment candidacy is an important consideration, then, for prospective participants and their caregivers, taking into account the potential high cost and extensive time commitment

involved in attending an ICAP. Prognosis for aphasia recovery in general is influenced by lesion size and location, by aphasia type and severity (Babbitt et al., 2016), and also by health status, motivation, family/caregiver support systems, and personal beliefs (Plowman et al., 2012). These factors are tantamount in PWA's decision to attend an ICAP. Additionally, some studies suggest that age is a predictor of response to treatment (Babbitt et al., 2016), while other studies have suggested it is not (Lazar & Antoniello, 2008). Endurance is another factor in ICAP participation, as respondents in Rose et al.'s updated 2021 survey pointed out that adequate stamina to remain alert, and ability to sit for four hours or more per day for the duration of the program are considerations and sometimes admission criteria.

This study is an examination of the pre-, post- and maintenance performance of a cohort of PWA who attended Idaho State University's Meridian Intensive Aphasia Program (MIAP) in Summer 2019. By the ICAP definition, the focus of treatment at MIAP addressed all levels of the WHO-ICF, including the participants' impairment, activity limitations, and participation restrictions, as well as impairment-based and functional communication goals with compensatory strategies. Home exercise programs were created and provided to all participants in an attempt to improve carryover and generalization of skills targeted in therapy. Participants were initially assessed with an abbreviated battery of standardized tests, which included measures of functional communication (CADL-2), impairment-based measures (BNT and the Comprehensive Aphasia Test (CAT); Swinburn, Porter, & Howard, 2004), and clients' own ratings of their communication confidence (CCRSA). Graduate students assessed the clients on the first day of MIAP and began treatment the following day (Gonzalez, 2020).

For this study, measurement of MIAP participants' performance is focused on the discourse samples they produced in response to seven specific elicitation tasks: 3 expository (two

sequential and one single picture description), 3 narrative (one familiar, one unfamiliar, one personal), and one procedural description task. PWA's discourse samples were analyzed in terms of their use of core verbs from Dalton et al.'s 2019 compendium of core lexicon lists, as well as their production of different verbs in each sample.

Hypotheses

H_0: There is no difference in PWA's use of verbs from a core lexicon list (Dalton & Richardson, 2019) in a range of discourse tasks following their participation in MIAP, based on pre-, post- and follow-up (1 month) data.

H_1: There is a difference in PWA's use of verbs from a core lexicon list (Dalton & Richardson, 2019) in a range of discourse tasks following their participation in MIAP, based on pre-, post- and follow-up (1 month) data.

H_0: There is no difference in the number of different verbs produced by PWA in a range of discourse tasks following their participation in MIAP, based on pre-, post- and follow-up (1 month) data.

H_2: There is a difference in the number of different verbs produced by PWA in a range of discourse tasks following their participation in MIAP, based on pre-, post- and follow-up (1 month) data.

Chapter II

Methods

Participants

Participants were recruited at the Idaho State University Speech Language Clinic (ISU SLC) and surrounding area hospitals via IRB-approved flyers. This resulted in the recruitment of 11 PWA who met the following inclusion criteria: over 18 years of age; native English speakers; normal or corrected-to-normal vision and hearing; confirmed neurological damage via CT/MRI scan and/or evaluation report that indicated a diagnosis of aphasia or traumatic brain injury by a medical professional; at least 4 months post onset of neurological damage; discharged from acute care services; a T-score above the cutoff for impairment on the CAT cognitive screening; and attended no outside therapy during MIAP (See Table 1 for demographic information). Exclusion criteria included the opposite of any of the above parameters, as well as current alcohol or substance abuse and current diagnosis from a medical professional of a cognitive or degenerative neurological disease process.

Table 1. *MIAP Participant Demographics*

Participant	Age	TPO (months)	Education Level	Gender	Aphasia Type
C1	78	78	Not reported	M	Nonfluent
C2	67	37	High School	F	Nonfluent
C3	58	8	High School	M	Nonfluent
C5	57	14	Some college	M	Nonfluent
C7	60	4	Bachelor's degree	F	Nonfluent
C8	43	6	9th grade	M	Nonfluent
C10	79	6	High School	M	Fluent
C17	33	6	College degree	F	Nonfluent
C18	59	20	Master's degree	M	Nonfluent
C19	61	11	Some graduate school	M	Nonfluent
C20	39	9	High school	F	Nonfluent

TPO = Time post onset, or length of time (in months) since stroke

All participants completed the ISU Clinic intake protocol which includes an information sheet, authorization for the release of PHI (protected health information), and consent to receive treatment. In addition, the approved informed consent form was reviewed section by section with each potential participant.

Experimenters

The experimenters included a certified SLP researcher and her lab assistants, two graduate student researchers, 10 graduate student clinicians, and 4 certified SLP supervisors. The researcher was responsible for providing feedback, direction in terms of writing and organization of research, securing IRB approval and grant funding, editing, and coordinating efforts between graduate student researchers and lab assistants for completion of transcripts and data analysis. Graduate student researchers were responsible for researching, writing, training for and hosting Zoom sessions with NBD participants to elicit control data, transcribing NBD samples and creating core verb lists for *PUPP* and *LETT*. Lab assistants transcribed MIAP participants' discourse samples, completed interrater reliability checks on PWA and NBD transcripts, coded them into CLAN, and generated data tables. Additionally, treatment at MIAP was provided by graduate student clinicians under the supervision of licensed SLPs and consisted of individual and group therapy, restorative and compensatory strategy training and practice, and a variety of evidence-based therapy approaches individualized to each PWA.

Research Design

This study is a retrospective, within-subjects cohort design, examining the application of an established quantitative discourse measure (core verbs) to analyze treatment effects of an evidence-based service delivery model (ICAP/MIAP). Transcripts of PWA's responses to narrative discourse elicitation tasks were created by trained graduate students from video

recordings of MIAP participants. These transcripts were analyzed using CLAN software to assign parts of speech to words spoken by participants, and verbs used in discourse tasks were compared to established core verb lists for the same discourse tasks. Interrater reliability (IRR) of transcripts was completed for 20% of randomly selected transcripts by two trained lab assistants and was found to be 95% overall across tasks. By task, IRR was 100% for *BW* and *RU*, 93% for *CR*, 92% for *CIND* and *LETT*, and 91% for *PUPP*.

Procedures

This research was approved by the International Review Board (IRB-FY2018-184). All participants signed an informed consent form prior to study onset.

Meridian Intensive Aphasia Program (MIAP)

MIAP is a modified ICAP lasting one instead of two weeks and totaling 1080 minutes of treatment with a Treatment Intensity Ratio (TIR) of 75%, calculated by dividing the total number of therapy hours by the total number of possible treatment hours (Babbitt, et al., 2015). Participants were assigned to one of two groups (week 1 or week 2) based on schedule preference. Multiple individual therapy sessions lasting 50 to 75 minutes each were provided daily after the first day; additionally, 1 to 2 group therapy sessions were included daily (Gonzalez, 2020). The discourse samples used in this study were collected from eleven PWA who attended MIAP in Meridian, Idaho during Summer 2019.

Program Schedule

Each week of MIAP had the same schedule structure, but with a separate group of student-client pairs. Monday, a half day for clients, included a large group orientation and individual diagnostic sessions in which assessments were administered. From Tuesday through Thursday, clients participated in several 50-75-minute individual and group sessions. On Friday

there was one last set of individual and group therapy sessions that included post-test measurements. Friday afternoon, the clients presented a PowerPoint presentation about their stroke story with the support of their student clinician in front of all program participants and available family members. MIAP clients participated in approximately 1260 total minutes (30 hours) of treatment across the five-day program period.

Diagnostics

Assessments were administered on Monday (pre-treatment) and Friday (post-treatment) of each week of MIAP, in diagnostic sessions lasting about 75 minutes. Follow-up assessments (maintenance) were completed 10-12 weeks after participants' completion of MIAP. For each administration (pre-, post- and maintenance), the assessment battery consisted of the same standardized tests, chosen for their validity and reliability in measuring PWA's functional communication skills (Communication Activities of Daily Living (CADL-2); Holland et al., 1999), their word-finding ability (Boston Naming Test (BNT); Goodglass et al., 2001), the extent of their language impairment (Comprehensive Aphasia Test (CAT); Swinburn et al., 2004), and the level of their communication confidence (Communication Confidence Rating Scale for Aphasia (CCRSA); Babbitt & Cherney, 2010).

Treatment Sessions

Individual treatment sessions were designed to support each participant's functional communication goals, which varied according to their strengths, deficits and individual profiles. Evidence-based approaches included Semantic Feature Analysis (SFA; Boyle & Coelho, 1995) and Verb Network Strengthening Treatment (VNeST; Edmonds et al., 2009) and other techniques suited to each PWA's unique needs and goals. Clinician-led group treatment sessions and informal lunches at the clinic site provided practical opportunities for clients to implement

the skills and techniques learned in individual sessions within a social context, facilitating generalization. Caregivers, friends and family members were invited to join some group therapy sessions, which included counseling and education on topics pertinent to living with aphasia, as well as stroke prevention and aphasia advocacy. In keeping with ICAP principles, treatment at MIAP targeted life participation, functional communication and language impairment goals for each PWA individually, while providing a range of opportunities for PWA to interact with other PWA in a social context supported by SLPs and graduate student clinicians.

Discourse Tasks

All PWA were administered seven discourse elicitation tasks. The order of task administration was randomized across participants, in keeping with protocol used by Kim and colleagues (2019). Discourse tasks included: 1 familiar narrative (*Cinderella*); 1 unfamiliar narrative (*Puppy Love*, a 1-minute video short); 3 expository tasks (1 single picture description: *Cat Rescue*; and two sequential picture descriptions: *Broken Window* and *Refused Umbrella*); 1 procedural description task (*Letter*); 1 personal narrative (*Illness/Stroke Story*). Six of the seven tasks, with the exception of *Puppy Love,* are commonly used in research and treatment of aphasic discourse. Core lexicon lists for *Cinderella (CIND), Cat Rescue (CR), Broken Window (BW)* and *Refused Umbrella (RU)* were published in Dalton and colleagues' 2019 compendium, and verbs from these lists will be used to analyze MIAP participant's performance on these four tasks. Core verb lists for *Puppy Love* (*PUPP*) and *Letter* (*LETT*) were created by transcribing and extrapolating the most commonly used verbs from discourse samples of eight non-brain-damaged (NBD) individuals, age-matched with PWA, who volunteered to participate in data collection for this study during the Spring of 2021. This process was consistent with protocols described by Kim et al. (2019) for developing core lexicon lists. Discourse samples from PWA

were collected in the MIAP clinical setting. The stimuli were presented as part of each PWA's pre-treatment, post-treatment, and follow-up assessment sessions. Discourse samples from NBD participants were collected via Zoom due to COVID restrictions in 2021. Trained graduate students presented the stimuli and instructions for both groups, following the same written elicitation protocols for NBD as for PWA.

Data Analysis

The independent variable in this study was MIAP participation, and the dependent variables were core verb and overall verb performance at pre- and post-treatment and follow-up data collection points. In the literature, core verb performance has been measured in terms of percent agreement, calculated by dividing the number of items produced by PWA in elicitation tasks by the total number of items on lexicon lists for those tasks (Kim & Wright, 2020). Due to the small number of usable samples from PWA for this study (n=8) and an inconsistent number of samples for each discourse task at each data point, descriptive analysis was used to illustrate overall change in verb production by individual participants. Overall verb performance was measured as a frequency count of the number of different verbs PWA produced in each elicitation task. Pre-treatment verb counts were compared to post-treatment and follow-up verb counts to measure change over time. Some trends in individual data will be examined specifically.

Chapter III

Results

Participants

This study utilized discourse samples collected from 11 PWA who attended MIAP in 2019. Participant demographics are in Table 1. Participants had an average age of 54.8 (SD = 15.2; Range = 33-78) and 13.9 years of education (SD = 3.1; Range = 9-18). There were 7 males and 4 females in the participant sample and time post-onset ranged between 4-78 months (M = 20.6; SD = 25.5). However, 3 PWA's samples were excluded, reducing the usable sample size to *n*=8 (4 males, 4 females). One excluded participant (C10) was ill during the week of MIAP and was only able to contribute 2 of 7 discourse samples. The other two (C3 and C18) required consistent student-clinician interjections for support during their discourse samples, rendering that data inadmissible due to deviation from elicitation protocols.

Core Verb Performance

To address this study's first hypothesis (H_1), core verb performance data was examined both at the individual and group level. Data were highly variable within individuals (discussed below and detailed in Tables 2.1-2.6) and changes in core verb production were generally small (e.g. number of core verbs C19 produced: +1 for *BW*; -4 for *RU*; -2 for *CR* and *CIND*; +3 for *PUPP*; no change for *LETT*). Consistent individual core verb performance worth noting includes C5, whose core verb use increased (+1 for *BW* and *LETT,* +4 for *PUPP*, +6 for *CIND*) for all tasks measured at pre-, post-, and follow-up, and C7, who made almost no change (+ or -1) in terms of core verb production across all tasks. The only participant who exhibited changes in core verb performance measured across tasks from pre- to post-MIAP to follow-up, as stated in H_1 was C5. Whole-group mean values for core verb percent agreement were skewed by missing

samples for different tasks at different data points. Mean percent agreement for tasks measured at all 3 data points (highlighted in Tables 2.1-2.6) increased slightly (~7%) for *RU* from pre-MIAP to follow-up, increased slightly (~7%) for *PUPP* from pre- to post-MIAP, then drooped near pre-MIAP levels at follow-up, but for *CIND* increased 20% from pre-MIAP to follow-up. Mean percent agreement for *CR* samples measured at all 3 data points increased 11% from pre- to post-MIAP, then settled at a lower 5.5% increase at follow-up. Whole-group mean for *CR* increased ~8% from pre-MIAP to follow-up (See Table 2).

Table 2. *Core Verb Performance per Discourse Type*

	n	Mean/total verbs (#)	Mean (%)	SD (%)	Range (%)
Broken Window / BW (Expository, Sequential Picture Description)					
Pre-MIAP	8	3.13/7	44.64	18.12	28.57 – 85.71
Post-MIAP	8	3/7	42.86	15.97	28.57 – 71.43
Follow up	5	3/7	42.86	12.78	28.57 – 57.14
Refused Umbrella / RU (Expository, Sequential Picture Description)					
Pre-MIAP	8	5.63/11	51.14	31.47	9.09 – 90.91
Post-MIAP	6	4.17/11	37.88	20.61	9.09 – 63.64
Follow up	5	5.2/11	47.27	21.82	9.09 – 72.73
Cat Rescue / CR (Expository, Single Picture Description)					
Pre-MIAP	6	3.5/9	38.89	13.98	22.22 – 55.26
Post-MIAP	6	4.17/9	46.3	16.25	22.22 – 66.67
Follow up	5	4.2/9	46.67	17.46	27.27 – 77.78
Cinderella / CIND (Narrative, Familiar Story Retell)					
Pre-MIAP	6	11.17/25	44.67	21.34	4 - 72
Post-MIAP	7	11.29/25	45.14	19.68	16 - 72
Follow up	4	10.75/25	43	24.23	16 - 76
[a]*Puppy Love / PUPP* (Narrative, Unfamiliar Story Retell)					
Pre-MIAP	8	4.38/11	39.77	17.57	9.09 – 63.64
Post-MIAP	8	4.38/11	39.77	24.87	9.09 – 72.73
Follow up	4	3.5/11	31.82	26.11	9.09 – 72.73
[a]*Letter / LETT* (Procedural, Familiar Task Description)					
Pre-MIAP	7	4/11	36.36	14.69	9.09 – 54.54
Post-MIAP	8	3.63/11	32.95	23.9	0 – 63.64
Follow up	6	3.17/11	28.79	23.23	0 – 63.64

Core Verb Performance represented as percent agreement (%), measured by dividing number of verbs PWA produced from Dalton & Richardson's (2019) core lexicon lists by the total number of verbs on each list, multiplied by 100:
(agree/total)*100 = percent agreement
n = number of participants' samples available/included in analysis
[a] Core verb lists derived from preliminary NBD control data

Table 2.1. *Percent Agreement of Verbs to Core Lexicon Lists for BW*

	PRE MIAP		POST MIAP		FOLLOW UP	
	Number Used (#)	Percent Agreement (%)	Number Used (#)	Percent Agreement (%)	Number Used (#)	Percent Agreement (%)
C1	2/7	28.57	2/7	28.57	2/7	28.57
C2	2/7	28.57	2/7	28.57	2/7	28.57
C5	3/7	42.86	4/7	57.14	4/7	57.14
C7	3/7	42.86	2/7	28.57	3/7	42.85
C8	2/7	28.57	2/7	28.57	--	--
C17	6/7	85.71	3/7	42.86	4/7	57.14
C19	3/7	42.86	4/7	57.14	--	--
C20	4/7	57.14	5/7	71.42	--	--
Mean	3/7	42.86	2.5/7	35.71	2.5/7	35.71
Whole-Group Mean	3.13	44.64	3	42.86	3	42.86

*Core Verb Performance represented as percent agreement (%), measured by dividing number of verbs PWA produced from Dalton & Richardson's (2019) core lexicon lists by the total number of verbs on each list, multiplied by 100: (agree/total)*100 = percent agreement.*
Highlighted rows signify complete data sets, used to calculate 'Mean' values.

Table 2.2. *Percent Agreement of Verbs to Core Lexicon Lists for RU*

	PRE MIAP		POST MIAP		FOLLOW UP	
	Number Used (#)	Percent Agreement (%)	Number Used (#)	Percent Agreement (%)	Number Used (#)	Percent Agreement (%)
C1	3/11	27.27	3/11	27.27	5/11	45.45
C2	3/11	27.27	6/11	54.55	5/11	45.45
C5	8/11	72.73	--	--	8/11	72.73
C7	2/11	18.18	2/11	18.18	1/11	9.09
C8	1/11	9.09	1/11	9.09	--	--
C17	9/11	81.82	--	--	7/11	63.64
C19	10/11	90.91	6/11	54.55	--	--
C20	9/11	81.82	7/11	63.64	--	--
Mean	2.25	20.45	3	27.27	3	27.27
Whole-Group Mean	5.63	51.14	4.17	37.88	5.2	47.27

*Core Verb Performance represented as percent agreement (%), measured by dividing number of verbs PWA produced from Dalton & Richardson's (2019) core lexicon lists by the total number of verbs on each list, multiplied by 100: (agree/total)*100 = percent agreement.*
Highlighted rows signify complete data sets, used to calculate 'Mean' values.

Table 2.3. *Percent Agreement of Verbs to Core Lexicon Lists for CR*

	PRE MIAP		POST MIAP		FOLLOW UP	
	Number Used (#)	Percent Agreement (%)	Number Used (#)	Percent Agreement (%)	Number Used (#)	Percent Agreement (%)
C1	4/9	44.44	6/9	66.67	7/9	77.78
C2	3/9	33.33	4/9	44.44	3/9	33.33
C5	--	--	4/9	44.44	4/9	44.44
C7	2/9	22.22	2/9	22.22	3/9	27.27
C8	2/9	22.22	--	--	--	--
C17	5/9	55.56	--	--	4/9	44.44
C19	5/9	55.56	3/9	33.33	--	--
C20	--	--	6/9	66.67	--	--
Mean	3	33.33	4	44.44	3.5	38.89
Whole-Group Mean	3.5	38.89	4.17	46.3	4.2	46.67

*Core Verb Performance represented as percent agreement (%), measured by dividing number of verbs PWA produced from Dalton & Richardson's (2019) core lexicon lists by the total number of verbs on each list, multiplied by 100: (agree/total)*100 = percent agreement.*
Highlighted rows signify complete data sets, used to calculate 'Mean' values.

Table 2.4. *Percent Agreement of Verbs to Core Lexicon Lists for CIND*

	PRE MIAP		POST MIAP		FOLLOW UP	
	Number Used (#)	Percent Agreement (%)	Number Used (#)	Percent Agreement (%)	Number Used (#)	Percent Agreement (%)
C1	10/25	40	8/25	32	--	--
C2	--	--	6/25	24	--	--
C5	13/25	52	18/25	72	19/25	76
C7	--	--	--	--	4/25	16
C8	1/25	4	4/25	16	6/25	24
C17	10/25	40	13/25	52	14/25	56
C19	18/25	72	16/25	64	--	--
C20	15/25	60	14/25	56	--	--
Mean	8	32	11.67	46.67	13	52
Whole-Group Mean	11.17	44.67	11.29	45.14	10.75	43

*Core Verb Performance represented as percent agreement (%), measured by dividing number of verbs PWA produced from Dalton & Richardson's (2019) core lexicon lists by the total number of verbs on each list, multiplied by 100: (agree/total)*100 = percent agreement.*
Highlighted rows signify complete data sets, used to calculate 'Mean' values.

Table 2.5. *Percent Agreement of Verbs to Core Lexicon Lists for PUPP*

	PRE MIAP		POST MIAP		FOLLOW UP	
	Number Used (#)	Percent Agreement (%)	Number Used (#)	Percent Agreement (%)	Number Used (#)	Percent Agreement (%)
C1	7/11	63.64	2/11	18.18	--	--
C2	5/11	45.46	3/11	27.27	--	--
C5	4/11	36.36	6/11	54.55	8/11	72.73
C7	1/11	9.09	1/11	9.09	1/11	9.09
C8	2/11	18.18	1/11	9.09	1/11	9.09
C17	6/11	54.55	8/11	72.73	4/11	36.36
C19	4/11	36.36	7/11	63.64	--	--
C20	6/11	54.55	7/11	63.64	--	--
Mean	3	27.27	3.8	34.54	3.2	29.09
Whole-Group Mean	4.38	39.77	4.38	39.77	3.5	31.82

*Core Verb Performance represented as percent agreement (%), measured by dividing number of verbs PWA produced from core lexicon lists derived from preliminary NBD control data by the total number of verbs on each list, multiplied by 100: (agree/total)*100 = percent agreement.*

Highlighted rows signify complete data sets, used to calculate 'Mean' values.

Table 2.6. *Percent Agreement of Verbs to Core Lexicon Lists for LETT*

	PRE MIAP		POST MIAP		FOLLOW UP	
	Number Used (#)	Percent Agreement (%)	Number Used (#)	Percent Agreement (%)	Number Used (#)	Percent Agreement (%)
C1	4/11	36.36	6/11	54.55	--	--
C2	--	--	0/11	0	2/11	18.18
C5	5/11	45.46	6/11	54.55	6/11	54.55
C7	1/11	9.09	0/11	0	1/11	9.09
C8	2/11	18.18	3/11	9.09	0/11	0
C17	5/11	45.46	7/11	63.64	3/11	27.27
C19	6/11	54.55	6/11	54.55	--	--
C20	5/11	45.46	3/11	27.27	7/11	63.64
Mean	3.6	32.73	3.4	30.91	3.4	30.91
Whole-Group Mean	4	36.36	3.63	32.95	3.17	28.79

*Core Verb Performance represented as percent agreement (%), measured by dividing number of verbs PWA produced from core lexicon lists derived from preliminary NBD control data by the total number of verbs on each list, multiplied by 100: (agree/total)*100 = percent agreement.*

Highlighted rows signify complete data sets, used to calculate 'Mean' values.

Number of Different Verbs

A look at the CLAN data revealed that total verb count from each discourse sample was inflated by repetitions of the same word, therefore, total number of *different* verbs was used rather than total verb count as a measure of PWA's overall verb performance. To address this study's second hypothesis (H_2), number of different verbs was examined both at the individual and group level. Collectively, group-level mean values for number of different verbs increased for *RU* (+1), *CR* (+2.5) and *CIND* (+3.5) from pre-MIAP to follow-up (See Table 3). Individual-level changes varied, and are described as follows and detailed in Tables 3.1-3.7:

- C1 increased for all expository tasks (+1 for *BW,* +3 for *RU,* +10 for *CR*) from pre-treatment to follow-up, and increased +3 for *CIND* from pre- to post-MIAP
- C2 increased for *RU* (+9 at post-MIAP, +4 at follow-up) and *CR* (+5 at follow-up)
- C5's different verb production doubled or nearly doubled for *BW* (6 to 11)*, RU* (11 to 17)*, CIND* (36 to 74), and *PUPP* (19 to 29) from pre-MIAP to follow-up
- C7 decreased for *BW, RU* and *PUPP* (-2 to -3), increased slightly for *CR, SS* and *LETT* (+1 to +4) from pre-MIAP to follow-up
- C8's different verb production doubled for *CIND* (11 to 22) from pre-MIAP to follow-up
- C17's different verb production decreased for every task from pre- to post- to follow-up, except *CIND* (+2) and *SS*, in which her different verbs increased from 15 to 32
- C19 had no follow-up data, but number of different verbs increased from 53 to 67 for *CIND* from pre- to post-treatment

- C20's number of different verbs increased slightly for *BW* (+2), *RU* (+1) and *PUPP* (+4) from pre- to post-treatment, and increased for *SS* from pre-treatment to follow-up (+13), but decreased from 46 to 28 (-18) for *CIND*.

Again, C5 was the only participant for whom a change in number of different verbs was observed across a range of discourse task types, and across data points, as written in H_2.

Table 3. *Number of Different Verbs per Discourse Type*

	n	Mean	SD	Range
Broken Window / BW				
(Expository, Sequential Picture Description)				
Pre-MIAP	8	7.86	3.23	5 – 15
Post-MIAP	8	7.25	2.43	4 - 10
Follow up	5	7.2	2.38	5 - 11
Refused Umbrella / RU				
(Expository, Sequential Picture Description)				
Pre-MIAP	8	10.88	4.85	6 - 20
Post-MIAP	6	10	6.26	4 - 17
Follow up	5	11.8	5.21	4 - 17
Cat Rescue / CR				
(Expository, Single Picture Description)				
Pre-MIAP	6	9.5	4.18	5 - 17
Post-MIAP	6	11.33	2.58	8 - 15
Follow up	5	12	4.3	8 - 19
Cinderella / CIND				
(Narrative, Familiar Story Retell)				
Pre-MIAP	7	32	16.84	11 - 53
Post-MIAP	7	31.29	28.27	12 - 67
Follow up	4	35.5	31.05	22 - 74
Puppy Love / PUPP				
(Narrative, Unfamiliar Story Retell)				
Pre-MIAP	8	14.25	7.34	4 - 23
Post-MIAP	8	16.5	8.7	3 - 28
Follow up	4	14	12.27	3 - 29
Stroke Story / SS				
(Narrative, Personal)				
Pre-MIAP	7	25.71	20.4	4 - 57
Post-MIAP	8	15.25	14.56	3 - 51
Follow up	5	21.8	25.45	2 - 59
Letter / LETT				
(Procedural, Familiar Task Description)				
Pre-MIAP	7	15.57	11.87	1 - 36
Post-MIAP	8	8.5	7.56	1 - 19
Follow up	6	7.67	5.32	1 - 15

n = number of participants' samples available/included in analysis
Mean = sum of number of different verbs across participants divided by n at each elicitation
SD = standard deviation from the Mean
Range = span of lowest number of different verbs to highest across participants at each elicitation

Table 3.1. *Number of Different Verbs for BW*

	PRE MIAP	POST MIAP	FOLLOW UP
C1	5	6	6
C2	8	7	6
C5	6	9	11
C7	7	4	5
C8	5	4	--
C17	9	8	8
C19	15	10	--
C20	8	10	--
Mean	7.88	7.25	7.2

Number of different verbs produced by each MIAP participant in each elicitation of *BW*.

Table 3.2. *Number of Different Verbs for RU*

	PRE MIAP	POST MIAP	FOLLOW UP
C1	7	4	10
C2	8	17	12
C5	11	--	17
C7	7	4	4
C8	6	5	--
C17	20	--	16
C19	14	15	--
C20	14	15	--
Mean	10.88	10	11.8

Number of different verbs produced by each MIAP participant in each elicitation of *RU.*

Table 3.3. *Number of Different Verbs for CR*

	PRE MIAP	POST MIAP	FOLLOW UP
C1	9	15	19
C2	8	11	13
C5	--	12	10
C7	7	9	8
C8	6	5	--
C17	20	--	10
C19	11	8	--
C20	--	13	--
Mean	9.5	11.33	12

Number of different verbs produced by each MIAP participant in each elicitation of *CR*.

Table 3.4. *Number of Different Verbs for CIND*

	PRE MIAP	POST MIAP	FOLLOW UP
C1	14	17	--
C2	--	12	--
C5	36	50	74
C7	--	--	12
C8	11	15	22
C17	32	30	34
C19	53	67	--
C20	46	28	--
Mean	32	31.29	35.5

Number of different verbs produced by each MIAP participant in each elicitation of *CIND*.

Table 3.5. *Number of Different Verbs for PUPP*

	PRE MIAP	POST MIAP	FOLLOW UP
C1	11	10	--
C2	15	16	--
C5	19	28	29
C7	5	3	3
C8	4	9	5
C17	23	23	19
C19	23	25	--
C20	14	18	--
Mean	14.25	16.5	14

Number of different verbs produced by each MIAP participant in each elicitation of *PUPP*.

Table 3.6. *Number of Different Verbs for Stroke Story (SS)*

	PRE MIAP	POST MIAP	FOLLOW UP
C1	19	12	--
C2	6	3	--
C5	35	16	10
C7	4	3	6
C8	5	11	2
C17	15	12	32
C19	57	51	--
C20	45	14	59
Mean	25.71	15.25	21.8

Number of different verbs produced by each MIAP participant in each elicitation of *SS*.

Table 3.7. *Number of Different Verbs for LETT*

	PRE MIAP	POST MIAP	FOLLOW UP
C1	21	15	--
C2	--	1	5
C5	36	9	14
C7	1	1	5
C8	5	2	1
C17	10	17	6
C19	22	19	--
C20	14	4	15
Mean	15.57	8.5	7.67

Number of different verbs produced by each MIAP participant in each elicitation of *LETT*.

Chapter IV

Discussion

When considering all eight PWA as a group, both core verb performance and number of different verbs showed an upward trend from pre-MIAP to follow-up for *CR*, the single picture description (expository) task. The group-level mean of number of different verbs also increased for *RU,* another expository task, and for *CIND*, a familiar narrative retell task. Group-level means in core verb performance for the remainder of tasks generally decreased from pre- to post-treatment to follow-up. Variability in number of different verbs produced between and within individuals was too high for other tasks to establish group-level trends. The inconsistency in these findings speak not only to the unique profile of each PWA and the variability in performance that characterizes aphasia, but also to the different cognitive and linguistic processes involved in each discourse task. Independent variables like age and education level, and distinct aphasia characteristics like lesion size, location, TPO, aphasia subtype and presence of concomitant disorders like apraxia and dysarthria may have contributed to the wide variability of outcomes in core verb percent agreement or number of different verbs.

Incomplete data sets for several participants also complicated calculations and reduced interpretability in the findings. As examples, for the unfamiliar narrative retell task, *PUPP*, and for *BW*, pre- and post-MIAP samples were collected from all eight participants, but follow-up data included only 4 and 5 participants, respectively. Ignoring the follow-up data, group-level core verb performance and number of different verbs from pre- and post-MIAP decreased slightly for these two tasks, seeming to indicate negative change, if any. However, a look past the numbers and at the actual verbs PWA produced reveals some qualitative increases, albeit small, despite the quantitative dips.

First, it's important to note a qualitative distinction between "light" or semantically simple verbs like *do, make, have* or *go* and "heavy" or more specific and substantive verbs (e.g. compare *go* with *hurry*, *get* with *find*, *come* with *arrive*) when examining verb production in PWA (Breedin et al., 1998). Looking specifically at C1's *BW* samples, there was only 1 substantive/heavy verb ("break") of the 5 different verbs he produced at pre-MIAP, but post-MIAP he used 2 heavy verbs, "hurt" and "kick," the latter of which is perhaps the most necessary verb in the story. At follow-up, C1 produced 3 heavy verbs in his *BW* sample, "fall," "mean," and "pick," which was possibly a phonetic paraphasia for "kick." C19's number of different verbs in *BW* decreased by 5 from pre- to post-MIAP, but only her post-MIAP sample included "kick." C8's number of different verbs in *BW* decreased by 1 from pre- to post-MIAP, but his use of heavy verbs increased by 1, from "kick" and "fix" (pre-MIAP) to "crash," "kick," and "run" (post-MIAP). C17's core verb percent agreement for *BW* decreased the most from pre-MIAP to follow-up (-2), but her follow-up sample included substantive verbs "kick" and "break" plus relevant verbs not on the core list, such as "hit," "see," and "do."

A look at C17's *PUPP* samples showed her core verb agreement ticked down by 18% from pre-MIAP to follow-up and her number of different verbs decreased from 23 at post-MIAP to 19 at follow-up, but the former sample included 4 different forms of the verb "be" and 3 forms of "do," while at follow-up she added "leave," "help," "sneak," "stay," "think," and "dig," the latter being among the most crucial verb elements of this story. Core verb agreement in *PUPP* for C8 decreased by half from 2 at pre-MIAP to 1 at post- and follow-up, but post-MIAP he added "miss" and "run" and his follow-up sample was the only one that included "rain" and "go." C7's core verb numbers for *PUPP* did not change across data points, but her samples included substantive verbs like "adopt," "jump," and "visit," which are integral to the story, but

just missed the cutoff (produced by at least half of NBD participants) for inclusion on the core verb list.

Puppy Love is a novel elicitation task, not yet represented in published data, but its use at MIAP has led to some encouraging gains for participants reflected in the pre- to post-MIAP increases in number of different verbs and core verb performance mean values. It will be necessary to collect more NBD samples of *PUPP* to build more robust core lexicon lists. Additionally, more research is necessary to establish reliability and internal/external validity, but a video stimulus like *PUPP* is likely to have high ecological validity as it's relevant to everyday life (Hallowell, 2017). As TV and internet videos have become an ever-present element of life in the digital age, PWA's ability to watch, recall and discuss them is likely to help them relate to friends and family, especially children and grandchildren.

Cat Rescue was the only expository task for which an upward group-level trend emerged from number of different verb data. This is consistent with results from Stark's 2019 study, which showed that expository tasks elicited the most diverse language. The group-level mean for number of different verbs also increased for *CIND*, and both *CR* (expository) and *CIND* (narrative) elicited a mean increase in core verb performance among PWA tested at all three data points. These results for *CIND* in particular, coupled with the sheer volume of verbs produced in *CIND* relative to the other tasks, affirm data from Stark (2019) which demonstrated that narrative tasks elicit the densest language (highest number of verbs, adjectives, adverbs, and function words, relative to total words).

Clinical factors and individual treatment elements within the MIAP setting must also be considered when analyzing this data. Treatment for each MIAP participant was individualized according to each PWA's functional goals. VNeST was a commonly used approach at MIAP

(Gonzalez, 2020), but daily sessions may or may not have addressed verbs specifically. This may be considered a strength of this study: that at least 1 of 8 PWA (C5) demonstrated relatively consistent and compelling gains in both verb measures, simply as a result of participation in a M-ICAP, is firstly a testament to MIAP, and secondly a (very) modest addition to the research supporting the use of core lexicon, and thirdly evidence to support an emphasis on verbs in evaluation and treatment of aphasia. Weaving a thread of connection between research by Stark (2019), Dalton and Richardson (2015), through Kim et al. (2019) and Kim and Wright (2020) was the true intention of this research.

Stark's (2019) research highlighted the importance of including multiple discourse task types in a comprehensive evaluation of PWA. With the stated purpose of determining whether and how selected linguistic variables were different between different discourse types elicited from PWA, results from Stark's study showed a main effect of discourse type on each linguistic variable she examined. As such, it's important for clinicians and researchers alike to choose discourse tasks that demonstrate sensitivity to the linguistic variable of interest, and to enlist the gamut of task types for a well-rounded and complete representation of PWA's linguistic abilities and/or change in response to treatment. This study honed in specifically on verb production as the variable of interest, utilizing Stark's (2019) findings to support the differences observed in verb performance within and among individual PWA across discourse tasks and data collection points in our data.

Dalton and Richardson (2015) sought to investigate the relationship between core lexicon (CoreLex) and main concept (MC) production, combining evidence-based microlinguistic (CoreLex) and macrolinguistic (MC) measures, and hypothesizing that the two measures would be positively correlated. Additionally, they contributed clinician-friendly checklists for real-time

analysis of both measures during the *BW* sequential picture description task (Dalton & Richardson, 2015; Richardson & Dalton, 2015). Results affirmed their hypothesis for both fluent (conduction, Wernicke's) and non-fluent (anomic, Broca's) aphasia subtypes and suggested that CoreLex might be an appropriate predictor of concept-level discourse abilities in PWA. This connection between CoreLex and MC, a salient macrolinguistic discourse measure, provided the basis for applying core lexicon analysis to the MIAP participants in this study. Results in the current study applied only to non-fluent aphasia and showed considerable variability among individuals. But Dalton and Richardson's 2015 study also provides an evidence base for clinical use of ready-made resources for *BW,* as results showed that "the CoreLex and MC analysis, alone or in addition to other analyses, may help to better predict response to treatment and functional improvements than traditional measures (e.g., naming ability) or standardized tests" (p. S936).

By providing preliminary evidence supporting the sound psychometric properties of the core lexicon measure, Kim and Wright's 2020 study strengthened the case for core lexicon as a valid and potentially useful measure of discourse performance. Core lexicon lists for verbs, nouns, adjectives, and function words were used to measure PWA's discourse in unfamiliar narrative retell tasks using two different wordless picture books. Core lexicon performance of various word types was shown to correlate significantly with various micro- and macrolinguistic measures like lexical diversity, coherence, syntactic complexity and information units. Core verbs, specifically, were significantly correlated with syntactic complexity and lexical diversity (Kim & Wright, 2020). Furthermore, concurrent validity and interrater reliability was established, providing empirical support for use of core lexicon measures in clinical and research settings. Findings from Kim et al.'s 2019 research provided the basis for focusing solely on verbs

in the current study, as verbs alone correlated significantly with aphasia severity in their investigation of core lexicon performance in four different word types across age cohorts. Core verb performance in the current study was not compared with any other micro- or macrolinguistic measures, but was examined across data collection points to measure change after participation in MIAP. This study was developed after samples were collected, so the focus on verb performance was not a consideration that informed individual treatment design or targeted selection of treatment approaches.

There are several "pros" to using core lexicon to analyze discourse in PWA. As described in the introduction, the primary appeal is its ease of use in a clinical setting, where "economy of assessment procedures is required" (Kim & Wright, 2020). Core lexicon checklists can be printed and items checked off in real time as a client is speaking during a structured discourse task. Minimal training is necessary, and usable resources are readily available (Dalton & Wright, 2020). Furthermore, and perhaps more importantly, recent studies have added psychometric properties like concurrent validity and interrater reliability (Kim & Wright, 2020) to the list of good reasons to implement core lexicon in discourse analysis**.** Development of core lexicon from NBD control samples adds a normative element to core lexicon as an assessment. As a discourse measure, core lexicon is especially suited as an evaluation of change after treatment, as it's been shown to correlate with main concept production (Dalton & Richardson, 2015), and several other macro- and microlinguistic variables (Kim & Wright, 2020), as well as help differentiate aphasia subtypes and severity (Dillow, 2013, Kim et al., 2019).

Although Dillow (2013) and Kim et al.'s (2019) data verified that verbs were a more sensitive predictor of language function than other word types, choosing to focus solely on core verbs rather than core lexicon as a whole, is overworking an already straightforward process.

Language is a system and verbs are only meaningful when used within phrases and sentences alongside other word classes to convey full and coherent ideas. To attend only to core verbs and ignore nouns, adjectives and function words strips away the context of a speaker's narrative. Dalton & Richardson (2015) pointed out that inclusion of function words such as conjunctions and prepositions often indicates more elaborate phrase and sentence structures, which would likely strengthen the relationship between microlinguistic measures like core lexicon and macrolinguistic discourse measures. Future studies should include all parts of speech to assess if there are changes in overall core lexicon use as a result of ICAP participation.

Additionally, looking only at core verbs produced by PWA and not at other relevant verbs they used limits our view of their own lexical skills, as shown in closer examinations of different verb production by MIAP participants in this study. Still, the current study constitutes a clinical nod toward verbs, and a suggestion that M-ICAP models like MIAP are effective in bringing about functional gains in participants with chronic aphasia. Perhaps a one-week program like MIAP results in limited gains for some PWA compared to a two-week ICAP, but for others two or more weeks may be unfeasible (limited attention, fatigue, logistics, etc.). It's important to consider stakeholders' (PWA themselves, caregivers, communication partners) perspectives regarding treatment outcomes, in addition to descriptive and statistical analyses, to judge meaningful change and treatment effectiveness.

It bears mentioning that ambiguous data in measures investigated in this study does not indicate that PWA did not make progress or functional gains at MIAP. Nor did a participant's exclusion from this study (e.g. C3, C10, C18) indicate they were unable to participate in and benefit from the treatment they received at MIAP. Some qualitative changes elude quantification and statistics, but are significant in the lives of PWA and their caregivers (Babbitt et al., 2021).

Treatment at MIAP, true to Rose et al.'s (2013) defining factors of ICAPs, involves individualized treatment, but also social opportunities among cohorts of PWA and their caregivers, constituting a "package" of therapy that participants in a 2021 survey by Babbitt et al. linked with better outcomes than traditional therapy.

Limitations and Future Directions

Timing of this research coincided with the COVID pandemic, and statewide/nationwide shelter-in-place orders. This led to complications around recruiting and interviewing NBD participants, which resulted in much smaller pool of NBD samples (n = 8) than originally planned. This limited the number of transcripts to use to create a core lexicon list for *PUPP*, and core lexicon is more representative of typical language when more people contribute language samples to it. For reason's previously described, it is this researcher's hope that a video stimulus like *PUPP* become a part of the gamut of narrative discourse tasks for PWA, with a core lexicon and main concept list developed from NBD controls to add to the existing compendium.

COVID quarantine also led to cancellation of MIAP 2020, reducing the potential to add more PWA data to this study. University closure led to timing and lab staffing constraints that limited the scope of analysis in this study. Correlating verb performance (e.g. percent substantive verbs, number of different verbs, noun-verb ratio) with another linguistic variable, such as lexical information units or, or even a qualitative measure like caregiver perception, would have widened the scope of this study, and is a necessary future direction.

Incomplete data sets were a complicating issue throughout the data in this study, which contributed to variability. This is likely a factor in any cohort of PWA, considering the concomitant motor and cognitive difficulties that often accompany aphasia. Three PWA's data were excluded for reasons of inconsistent participation and difficulty with task administration,

which not only reduced sample size (another limitation), but unfortunately removed the only participant in the group with fluent aphasia. This was especially unfortunate because fluent aphasia is relatively rare, but the inclusion of only nonfluent PWA in the sample is a limitation of this research. Finally, the step from core lexicon to focusing exclusively on core verbs may be a step too far. Research supports the implementation of core lexicon which includes multiple parts of speech, and that's a clear enough future direction.

This research is part of a larger ongoing project to analyze different discourse measures before and after PWA participate in MIAP. The primary contribution of this study was to examine the micro-level of verbs (core verb performance and number of different verbs) across a battery of discourse elicitation methods within the ICAP treatment model. Fortunately, this research has a counterpart investigating lexical diversity, and both studies are part of a growing body of work investigating MIAP outcomes.

Conclusions

Although a measure like core lexicon is relatively simple, discourse analysis is not. Despite the continued work of researchers to simplify it, elicitation and analysis is a complex process that must include a range of methods. Core lexicon, verb measures and naming tasks all have their rightful place in a complete assessment, and clinical decisions should not be derived from a single measure, but from a comprehensive evidence-based evaluation. A stated aim of this study was to contribute to the research base for discourse analysis in aphasia. There is a lot more work to be done in the research and clinical world regarding discourse, and integration of elicitation and analysis across aphasia literature will drive that work in the right direction.

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APPENDIX A

Core Verb Lists

Table A1. Core Verb Lists

Broken Window/*BW* *(7)*	Refused Umbrella/*RU* *(11)*	Cat Rescue/*CR* *(9)*	Cinderella/*CIND* *(25)*	[a]Puppy Love/*PUPP* *(11)*	[a]Letter/*LETT* *(11)*
be	be	bark	be	be	address
break	do	be	come	become	be
go	get	call	dance	bring	fold
kick	go	climb	do	do	get
look	have	come	find	go	have
play	need	get	fit	get	put
sit	rain	go	get	have	say
	say	have	go	keep	send
	start	stick	have	know	take
	take		know	see	will
	walk		leave	take	write
			like		
			live		
			look		
			lose		
			make		
			marry		
			run		
			say		
			strike		
			take		
			tell		
			try		
			turn		
			want		

BW, RU, CR, and *CIND* verb lists developed from Core Lexicon lists from Dalton et al. (2019)
[a]*PUPP* and *LETT* developed from preliminary NBD data, include words produced by 50% of NBD participants
"Light" verbs in blue, "heavy" verbs in black (Mayer & Murray, 2003)

APPENDIX B

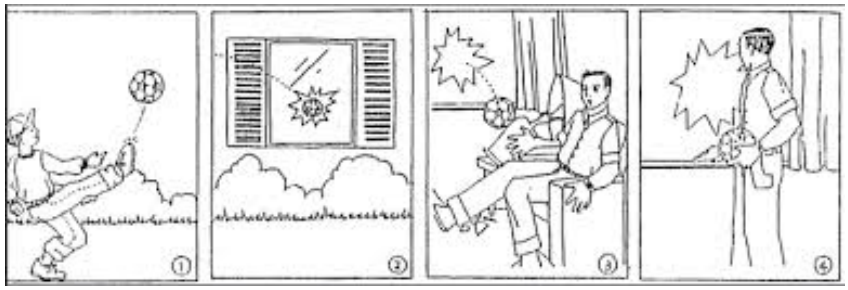
Discourse Tasks

Broken Window / *BW*

Expository

Sequenced Picture Description

Figure B1. *Broken Window* Stimulus

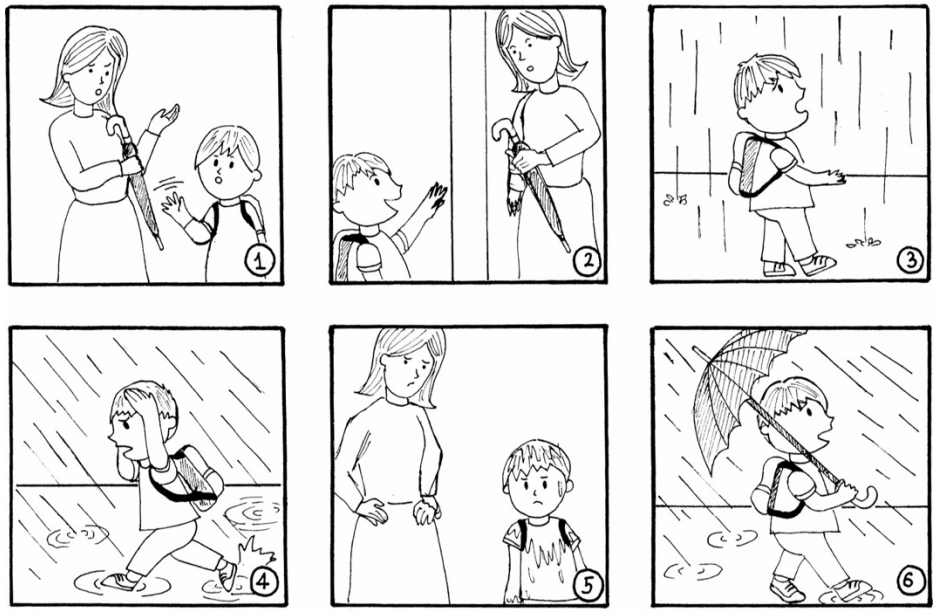


Refused Umbrella / *RU*

Expository

Sequenced Picture Description

Figure B2. *Refused Umbrella* Stimulus

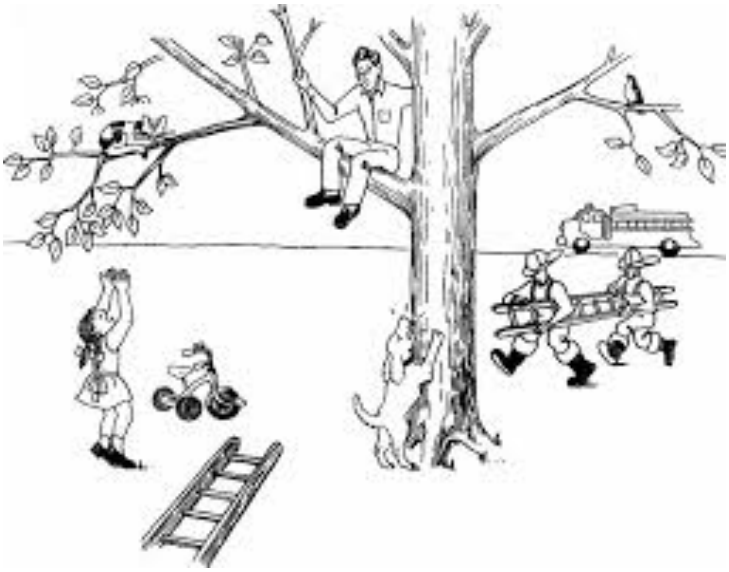


Cat Rescue / *CR*

Expository

Single Picture Description

Figure B3. *Cat Rescue* Stimulus



Cinderella Story / *CIND*

Narrative

Familiar Story Retell

Tell as much of the story of Cinderella as you can after looking at pictures provided

Puppy Love / *PUPP*

Narrative

Unfamiliar Story Retell (Dynamic)

Watch the video and retell the story looking at pictures provided

Access Puppy Love video at https://www.youtube.com/watch?v=dlNO2trC-mk

Stroke Story / *SS*

Personal Narrative

Tell me about your stroke and your recovery process

Letter / *LETT*

Procedural Description

Describe how to write and send a letter